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AN HISTORY OF THE EARTH, AND ANIMATED NATURE.

By OLIVER GOLDSMITH.

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CONTENTS.

Of INSECTS.

PART III.

Page
CHAP. I. OF Caterpillars in general 3
II. Of the Transformations of the Caterpillar into its correſponding Butterfly, or Moth 7
III. Of Butterflies and Moths — 32
IV. Of the Enemies of the Caterpillar, 43
V. Of the Silk-Worm — 49

PART IV.

CHAP. I. Of the Fourth Order of Inſects 63
II. Of the Bee — — 65
III. Of the Waſp — 96
IV. Of the Ichneumon-Fly — 111
V. Of the Ant — — 115
VI. Of the Beetle, and its Varieties 128
VII. Of the Gnat and the Tipula 151

PART. V.

VIII. Of Zoophytes in general 161
IX. Of Worms — — 166

CONTENTS.

Chap. Page
X. Of the Star-Fiſh — 174
XI. Of the Polypus — — 179
XII. Of Lithophytes and Sponges 192

9 OCT 48

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INSECTS.

PART III.

BRITISH MUSEUM
9 OCT 46

AN HISTORY OF INSECTS.

CHAP. I.

Of Caterpillars in General.

IF we take a curſory view of inſects in general, caterpillars alone, and the butterflies and moths they give birth to, will make a third part of the number. Wherever we move, wherever we turn, theſe inſects, in one ſhape or another, preſent themſelves to our view. Some, in every ſtate, offer the moſt entertaining ſpectacle; others are beautiful only in their winged form. Many perſons, of which number I am one, have an invincible averſion to caterpillars, and worms of every ſpecies; there is ſomething diſagreeable in their ſlow crawling motion, for which the variety of their colouring can never compenſate. But others feel no repugnance at obſerving, and even handling them with the moſt attentive application.

There is nothing in the butterfly ſtate, ſo beautiful or ſplendid as theſe inſects. They ſerve, not leſs than the birds themſelves to baniſh ſolitude from our walks, and to fill up our idle intervals with the moſt pleaſing ſpeculations. The butterfly makes one of the principal ornaments of oriental poetry; but, in thoſe countries, the inſect is larger and more beautiful than with us.

The beauties of the fly may therefore very well excite our curioſity to examine the reptile. But we are ſtill more ſtrongly attached to this tribe, from the uſefulneſs of one of the number. The ſilkworm is, perhaps, the moſt ſerviceable of all other animals; ſince, from its labours, and the manufacture attending it, near a third part of the world are cloathed, adorned, and ſupported.

Caterpillars may be eaſily diſtinguiſhed from worms or maggots, by the number of their feet; and by their producing butterflies or moths. When the ſun calls up vegetation, and vivifies the various eggs of inſects, the caterpillars are the firſt that are ſeen, upon almoſt every vegetable and tree, eating its leaves, and preparing for a ſtate of greater perfection. They have feet both before and behind; which not only enable them to move forward by a ſort of ſteps made by their fore and hinder parts, but alſo to climb up vegetables, and to ſtretch themſelves out from the boughs and ſtalks, to reach their food at a

9 OCT 48

diſtance. All of this claſs have from eight feet at the leaſt, to ſixteen; and this may ſerve to diſtinguiſh them from the worm tribe, that never have ſo many. The animal into which they are converted, is always a butterfly or a moth; and theſe are always diſtinguiſhed from other flies, by having their wings covered over with a painted duſt, which gives them ſuch various beauty. The wings of flies are tranſparent, as we ſee in the common fleſh fly; while thoſe of beetles are hard, like horn: from ſuch the wing of a butterfly may be eaſily diſtinguiſhed; and words would obſcure their differences.

From hence it appears, that caterpillars, whether in the reptile ſtate, or advanced to their laſt ſtate of perfection into butterflies, may eaſily be diſtinguiſhed from all other inſects; being animals peculiarly formed, and alſo of a peculiar nature. The tranſmutations they undergo, are alſo more numerous than thoſe of any inſect hitherto mentioned; and, in conſequence, they have been placed in the third order of changes by Swammerdam, who has thrown ſuch lights upon this part of natural hiſtory. In the ſecond order of changes, mentioned before, we ſaw the graſshopper and the earwig, when excluded from the egg, aſſume a form very like that which they were after to preſerve; and ſeemed arrived at a ſtate of perfection, in all reſpects, except in not having wings; which did not bud forth until they were come to maturity. But the inſects of this third order, that we are now about to deſcribe, go through a much greater variety of transformations: for, when they are excluded from the egg, they aſſume the form of a ſmall caterpillar, which feeds and grows larger every day, often changing its ſkin, but ſtill preſerving its form. When the animal has come to a certain magnitude in this ſtate, it diſcontinues eating, makes itſelf a covering or huſk, in which it remains wrapped up, ſeemingly without life or motion; and after having for ſome time continued in this ſtate, it once more burſts its confinement, and comes forth a beautiful butterfly. Thus we ſee this animal put on no leſs than three different appearances, from the time it is firſt excluded from the egg. It appears a crawling caterpillar; then an inſenſible aurelia, as it is called, without life or motion; and laſtly, a butterfly, variouſly painted, according to its different kind. Having thus diſtinguiſhed this claſs of inſects from all others, we will firſt ſurvey their hiſtory in general; and then enter particularly into the manners and nature of a few of them, which moſt deſerve our curioſity and attention.

CHAP. II.

Of the Tranſformation of the Caterpillar into its correſponding Butterfly or Moth.

WHEN winter has diſrobed the trees of their leaves, nature then ſeems to have loſt her inſects. There are thouſands of different kinds, with and without wings; which, though ſwarming at other ſeaſons, then entirely diſappear. Our fields are re-peopled, when the leaves begin to bud, by the genial influence of ſpring; and caterpillars, of various ſorts, are ſeen feeding upon the promiſe of the year, even before the leaves are completely unfolded. Thoſe caterpillars, which we then ſee, may ſerve to give us a view of the general means which nature employs to preſerve ſuch a number of inſects during that ſeaſon, when they can no longer find ſubſiſtence. It is known, by united experience, that all theſe animals are hatched from the eggs of butterflies; and thoſe who obſerve them more cloſely, will find the fly very careful in depoſiting its eggs in thoſe places where they are likely to be hatched with the greateſt ſafety and ſucceſs. During winter, therefore, the greateſt number of caterpillars are in an egg ſtate; and in this lifeleſs ſituation, brave all the rigours and the humidity of the climate: and though often expoſed to all its changes, ſtill preſerve the latent principles of life, which is more fully exerted at the approach of ſpring. That ſame power that puſhes forth the budding leaf, and the opening flower, impels the inſect into animation; and Nature at once ſeems to furniſh the gueſt and the banquet. When the inſect has found force to break its ſhell, it always find its favourite aliment provided in abundance before it.

But all caterpillars are not ſent off from the egg in the beginning of ſpring; for many of them have ſubſiſted during the winter in their aurelia ſtate: in which, as we have briefly obſerved above, the animal is ſeemingly deprived of life and motion. In this ſtate of inſenſibility, many of theſe inſects continue during the rigours of winter; ſome encloſed in a kind of ſhell, which they have ſpun for themſelves at the end of autumn; ſome concealed under the bark of trees; others in the chinks of old walls; and many buried under ground. From all theſe, a variety of butterflies are ſeen to iſſue, in the beginning of ſpring; and adorn the earlieſt part of the year with their painted flutterings.

Some caterpillars do not make any change whatſoever at the approach of winter; but continue to live in their reptile ſtate, through all the ſeverity of the ſeaſon. Theſe chuſe themſelves ſome retreat, where they may remain undiſturbed for ſome months together; and there they remain, quite motionleſs, and as inſenſible as if they were actually dead. Their conſtitution is ſuch, that food, at that time, would be uſeleſs; and the cold prevents their making thoſe diſſipations which require reſtoration. In general, caterpillars of this kind are found in great numbers together, encloſed in one common web, that covers them all, and ſerves to protect them from the injuries of the air.

Laſtly, there are ſome of the caterpillar kind, whoſe butterflies live all the winter; and who, having fluttered about for ſome part of the latter end of autumn, ſeek for ſome retreat during the winter, in order to anſwer the ends of propagation, at the approach of ſpring. Theſe are often found lifeleſs and motionleſs in the hollows of trees, or the clefts of timber; but, by being approached to the fire, they recover life and activity, and ſeem to anticipate the deſires of the ſpring.

In general, however, whether the animal has ſubſiſted in an egg ſtate, during the winter; or whether as a butterfly, bred from an aurelia, in the beginning of ſpring; or a butterfly that has ſubſiſted during the winter, and lays eggs as ſoon as the leaves of plants are ſhot forward, the whole ſwarm of caterpillars are in motion to ſhare the banquet that Nature has provided. There is ſcarce a plant that has not its own peculiar inſects; and ſome are known to ſupport ſeveral of different kinds. Of theſe, many are hatched from the egg, at the foot of the tree, and climb up to its leaves for ſubſiſtence: the eggs of others, have been glued by the parent butterfly to the leaves; and they are no ſooner excluded from the ſhell, but they find themſelves in the midſt of plenty.

When the caterpillar firſt burſts from the egg, it is ſmall and feeble; its appetites are in proportion to its ſize, and it ſeems to make no great conſumption: but as it encreaſes in magnitude, it improves in its appetites; ſo that, in its adult caterpillar ſtate, it is the moſt ravenous of all animals whatſoever. A ſingle caterpillar will eat double its own weight of leaves in a day, and yet ſeems no way diſordered by the meal.—What would mankind do, if their oxen or their horſes were ſo voracious!

Theſe voracious habits, with its ſlow crawling motion, but ſtill more a ſtinging like that of nettles, which follows upon handling the greateſt number of them, make theſe inſects not the moſt agreeable objects of human curioſity. However, there are many philoſophers who have ſpent years in their contemplation; and who have not only attended to their habits and labours, but minutely examined their ſtructure and internal conformation.

The body of the caterpillar, when anatomically conſidered, is found compoſed of rings, whoſe circumference is pretty near circular or oval. They are generally twelve in number, and are all membranaceous; by which caterpillars may be diſtinguiſhed from many other inſects, that nearly reſemble them in form. The head of the caterpillar is connected to the firſt ring by the neck; that is generally ſo ſhort and contracted, that it is ſcarce viſible. All the covering of the head in caterpillars ſeems to conſiſt of a ſhell; and they have neither upper nor under jaw, for they are both place rather vertically, and each jaw armed with a large thick tooth, which is ſingly equal to number. With theſe the animals devour their food in ſuch amazing quantities; and with theſe, ſome of the kind defend themſelves againſt their enemies. Though the mouth be kept ſhut, the teeth are always uncovered; and while the inſect is in health, they are ſeldom without employment. Whatever the caterpillar devours, theſe teeth ſerve to chop it into ſmall pieces, and render the parts of the leaf fit for ſwallowing. Many kinds, while they are yet young, eat only the ſucculent part of the leaf, and leave all the fibres untouched; others, however, attack the whole leaf, and eat it clean away. One may be amuſed, for a little time, in obſerving the avidity with which they are ſeen to feed; ſome are ſeen eating the whole day; others have their hours of repaſt; ſome chuſe the night, and others the day. When the caterpillar attacks a leaf, it places its body in ſuch a manner that the edge of the leaf ſhall fall between its feet, which keeps it ſteady, while the teeth are employed in cutting it: theſe fall upon the leaf, ſomewhat in the manner of a pair of gardener's ſheers; and every morſel is ſwallowed as ſoon as cut. Some caterpillars feed upon leaves ſo very narrow, that they are not broader than their mouths; in this caſe the animal is ſeen to devour it from the point, as we would eat a radiſh.

As there are various kinds of caterpillars, the number of their feet are various; ſome having eight, and ſome ſixteen. Of theſe feet the ſix foremoſt are covered with a ſort of ſhining griſtle; and are therefore called the ſhelly legs. The hindmoſt feet, whatever be their number, are ſoft and flexible, and are called membranaceous. Caterpillars alſo, with regard to their external figure, are either ſmooth, or hairy. The ſkin of the firſt kind is ſoft to the touch, or hard, like ſhagreen; the ſkin of the latter, is hairy, and as it were thorny; and generally, if handled, ſtings like nettles. Some of them even cauſe this ſtinging pain, if but approached too nearly.

Caterpillars, in general, have ſix ſmall black ſpots placed on the circumference of the fore ring, and a little to the ſide of the head. Three of theſe are larger than the reſt, and are convex and tranſparent: theſe Reaumur takes to be the eyes of the caterpillar; however, moſt of theſe reptiles have very little occaſion for ſight, and ſeem only to be directed by their feeling.

But the parts of the caterpillar's body which moſt juſtly demand our attention, are the ſtigmata, as they are called: or thoſe holes on the ſides of its body, through which the animal is ſuppoſed to breathe. All along this inſect's body, on each ſide, theſe holes are eaſily diſcoverable. They are eighteen in number, nine on a ſide, rather nearer the belly than the back; a hole for every ring, of which the animal's body is compoſed, except the ſecond, the third, and the laſt. Theſe oval openings may be conſidered as ſo many mouths, through which the inſect breathes; but with this difference, that as we have but one pair of lungs, the caterpillar has no leſs than eighteen. It requires no great anatomical dexterity to diſcover theſe lungs in the larger kind of caterpillars: they appear, at firſt view, to be hollow cartilaginous tubes, and of the colour of mother-of-pearl. Theſe tubes are often ſeen to unite with each other; ſome are perceived to open into the inteſtines; and ſome go to different parts of the ſurface of the body. That theſe veſſels ſerve to convey the air, appears evidently, from the famous experiment of Malpighi; who, by ſtopping up the mouths of the ſtigmata with oil, quickly ſuffocated the animal, which was ſeen to die convulſed the inſtant after. In order to aſcertain his theory, he rubbed oil upon other parts of the inſect's body, leaving the ſtigmata free; and this ſeemed to have no effect upon the animal's health, but it continued to move and eat as uſual: he rubbed oil on the ſtigmata of one ſide, and the animal underwent a partial convulſion, but recovered ſoon after. However, it ought to be obſerved, that air is not ſo neceſſary to theſe as to the nobler ranks of animals, ſince caterpillars will live in an exhauſted receiver for ſeveral days together; and though they ſeem dead at the bottom, yet, when taken out, recover, and reſume their former vivacity.

If the caterpillar be cut open longitudinally along the back, it inteſtines will be perceived running directly in a ſtraight line from the mouth to the anus. They reſemble a number of ſmall bags opening into each other; and ſtrengthened on both ſides by a fleſhy cord, by which they are united. Theſe inſects are, upon many occaſions, ſeen to caſt forth the internal coat of their inteſtines with their food, in the changes which they ſo frequently undergo. But the inteſtines take up but a ſmall part of the animal's body, if compared to the fatty ſubſtance in which they are involved. This ſubſtance changes its colour when the inſect's metamorphoſis begins to approach; and from white it is uſually ſeen to become yellow. If to theſe parts, we add the caterpillar's implements for ſpinning, (for all caterpillars ſpin at one time or another) we ſhall have a rude ſketch of this animal's conformation: however, we ſhall reſerve the deſcription of thoſe parts, till we come to the hiſtory of the ſilk-worm, where the manner in which theſe inſects ſpin their webs, will moſt properly find place.

The life of a caterpillar ſeems one continued ſucceſſion of changes; and it is ſeen to throw off one ſkin only to aſſume another; which alſo is diveſted in its turn: and thus for eight or ten times ſucceſſively. We muſt not, however, confound this changing of the ſkin with the great metamorphoſis which it is afterwards to undergo. The throwing off one ſkin, and aſſuming another, ſeems, in compariſon, but a ſlight operation among theſe animals; this is but the work of a day; the other is the great adventure of their lives. Indeed, this faculty of changing the ſkin, is not peculiar to caterpillars only, but is common to all the inſect kind; and even to ſome animals that claim a higher rank in nature. We have already ſeen the lobſter and the crab out-growing their firſt ſhells, and then burſting from their confinement, in order to aſſume a covering more roomy and convenient. It is probable that the louſe, the flea, and the ſpider, change their covering from the ſame neceſſity; and growing too large for the cruſt in which they have been for ſome time encloſed, burſt it for another. This period is probably that of their growth; for as ſoon as their new ſkin is hardened round them, the animal's growth is neceſſarily circumſcribed, while it remains within it. With reſpect to caterpillars, many of them change their ſkins five or ſix times in a ſeaſon; and this

this covering, when caſt off, often ſeems ſo complete, that many might miſtake the empty ſkin for the real inſect. Among the hairy caterpillars, for inſtance, the caſt ſkin is covered with hair; the feet, as well griſtly as membraneous, remain fixed to it; even the parts which nothing but a microſcope can diſcover, are viſible in it; in ſhort, all the parts of the head; not only the ſkull, but the teeth.

In proportion as the time approaches in which the caterpillar is to caſt its old ſkin, its colours become more feeble, the ſkin ſeems to wither and grow dry, and in ſome meaſure reſembles a leaf, when it is no longer ſupplied with moiſture from the ſtock. At that time, the inſect begins to find itſelf under a neceſſity of changing; and it is not effected without violent labour, and perhaps pain. A day or two before the critical hour approaches, the inſect ceaſes to eat, loſes its uſual activity, and ſeems to reſt immoveable. It ſeeks ſome place to remain in ſecurity; and no longer timorous, ſeems regardleſs even of the touch. It is now and then ſeen to bend itſelf and elevate its back; again it ſtretches to its utmoſt extent: it ſometimes lifts up the head, and then lets it fall again; it ſometimes waves it three or four times from ſide to ſide, and then remains in quiet. At length, ſome of the rings of its body, particularly the firſt and ſecond, are ſeen to ſwell conſiderably, the old ſkin diſtends and burſts, till, by repeated ſwellings and contractions in every ring, the animal diſengages itſelf, and creeps from its inconvenient covering.

How laborious ſoever this operation may be, it is performed in the ſpace of a minute; and the animal, having thrown off its old ſkin, ſeems to enjoy new vigour, as well as acquired colouring and beauty. Sometimes it happens, that it takes a new appearance, and colours very different from the old. Thoſe that are hairy, ſtill preſerve their covering; although their ancient ſkin ſeems not to have loſt a ſingle hair: every hair appears to have been drawn, like a ſword from the ſcabbard. However, the fact is, that a new crop of hair grows between the old ſkin and the new, and probably helps to throw off the external covering.

The caterpillar having in this manner continued for ſeveral days feeding, and at intervals caſting its ſkin, begins at laſt to prepare for its change into an aurelia. It is moſt probable that, from the beginning, all the parts of the butterfly lay hid in this inſect, in its reptile ſtate; but it required time to bring them to perfection; and a large quantity of food, to enable the animal to undergo all the changes requiſite for throwing off theſe ſkins, which ſeemed to clog the butterfly form. However, when the caterpillar has fed ſufficiently, and the parts of the future butterfly have formed themſelves beneath its ſkin, it is then time for it to make its firſt great and principal change into an aurelia, or a chryſalis, as ſome have choſen to call it; during which, as was obſerved, it ſeems to remain for ſeveral days, or even months, without life or motion.

Preparatory to this important change, the caterpillar moſt uſually quits the plant, or the tree on which it fed; or at leaſt attaches itſelf to the ſtalk or the ſtem, more gladly than the leaves. It forſakes its food, and prepares, by faſting, to undergo its tranſmutation. In this period, all the food it has taken is thoroughly digeſted; and it often voids even the internal membrane which lined its inteſtines. Some of this tribe, at this period alſo, are ſeen entirely to change colour; and the vivacity of the tints in all, ſeem faded. Thoſe of them which are capable of ſpinning themſelves a web, ſet about this operation; thoſe which have already ſpun, await the change in the beſt manner they are able. The web or cone, with which ſome cover themſelves, hides the aurelia contained within from the view; but in others, where it is more tranſparent, the caterpillar, when it has done ſpinning, ſtrikes into the claws of the two feet under the tail, and afterwards forces in the tail itſelf, by contracting thoſe claws, and violently ſtriking the feet one againſt the other. If, however, they be taken from their web at this time, they appear in a ſtate of great languor; and, incapable of walking, remain on that ſpot where they are placed. In this condition they remain one or two days, preparing to change into an aurelia; ſomewhat in the manner they made preparations for changing their ſkin. They then appear with their bodies bent into a bow, which they now and then are ſeen to ſtraiten: they make no uſe of their legs; but if they attempt to change place, do it by the contortions of their body. In proportion as their change into an aurelia approaches, their body become more and more bent; while their extenſions and convulſive contractions become more frequent. The hinder end of the body is the part which the animal firſt diſengages from its caterpillar ſkin; that part of the ſkin remains empty, while the body is drawn up contracted towards the head. In the ſame manner they diſengage themſelves from the two ſucceeding rings; ſo that the animal is then lodged entirely in the fore part of its caterpillar covering: that half which is abandoned, remains flaccid and empty; while the fore part, on the contrary, is ſwolen and diſtended. The animal, having thus quitted the hinder part of its ſkin to drive itſelf up into the fore part, ſtill continues to heave and work as before; ſo that the ſkull is ſoon ſeen to burſt into three pieces, and a longitudinal opening is made in the three firſt rings of the body, through which the inſect thruſts forth its naked body, with ſtrong efforts. Thus at laſt, it entirely gets free from its caterpillar ſkin, and for ever forſakes its moſt odious reptile form.

The caterpillar, thus ſtripped of its ſkin for the laſt time, is now become an aurelia; in which the parts of the future butterfly are all viſible; but in ſo ſoft a ſtate, that the ſmalleſt touch can diſcompoſe them. The animal is now become helpleſs and motionleſs; but only waits for the aſſiſtance of the air to dry up the moiſture on its ſurface, and ſupply it with a cruſt capable of reſiſting external injuries. Immediately after being ſtripped of its caterpillar ſkin, it is of a green colour, eſpecially in thoſe parts which are diſtended by an extraordinary afflux of animal moiſture; but in ten or twelve hours after being thus expoſed, its parts harden, the air forms its external covering into a firm cruſt, and in about four and twenty hours, the aurelia may be handled without endangering the little animal that is thus left in ſo defenceleſs a ſituation. Such is the hiſtory of the little pod or cone that is found ſo common by every pathway, ſticking to nettles, and ſometimes ſhining like poliſhed gold. From the beautiful and reſplendent colour, with which it is thus ſometimes adorned, ſome authors have called it a Chryſalis, implying a creature made of gold.

Such are the efforts by which theſe little animals prepare for a ſtate of perfection; but their care is ſtill greater to provide themſelves a ſecure retreat, during this ſeaſon of their imbecility. It would ſeem like erecting themſelves a monument, where they were to reſt ſecure, until Nature had called them into a new and more improved exiſtence. For this purpoſe, ſome ſpin themſelves a cone or web, in which they lie ſecure till they have arrived at maturity: others, that cannot ſpin ſo copious a covering, ſuſpend themſelves by the tail, in ſome retreat where they are not likely to meet diſturbances. Some mix ſand with their gummy and moiſt webs, and thus make themſelves a ſecure incruſtation; while others, before their change, bury themſelves in the ground, and thus avoid the numerous dangers that might attend them. One would imagine that they were conſcious of the preciſe time of their continuance in their aurelia ſtate; ſince their little ſepulchres, with reſpect to the ſolidity of the building, are proportioned to ſuch duration. Thoſe that are to lie in that ſtate of exiſtence but a few days, make choice of ſome tender leaf, which they render ſtill more pliant by diffuſing a kind of glue upon it: the leaf thus gradually curls up, and withering as it enfolds, the inſect wraps itſelf within, as in a mantle, till the genial warmth of the ſun enables it to ſtruggle for new life, and burſt from its confinement. Others, whoſe time of transformation is alſo near at hand, faſten their tails to a tree, or to the firſt worm-hole they meet, in a beam, and wait in that defenceleſs ſituation. Such caterpillars, on the other hand, as are ſeen to lie ſeveral months in their aurelia ſtate, act with much greater circumſpection. Moſt of them mix their web with ſand, and thus make themſelves a ſtrong covering: others build in wood, which ſerves them in the nature of a coffin. Such as have made the leaves of willows their favourite food, break the tender twigs of them firſt into ſmall pieces, then pound them as it were to powder; and, by means of their glutinous ſilk, make a kind of paſte, in which they wrap themſelves up. Many are the forms which theſe animals aſſume in this helpleſs ſtate; and it often happens, that the moſt deformed butterflies iſſue from the moſt beautiful aurelias.

In general, however, the aurelia takes the rude outline of the parts of the animal which is contained within it; but as to the various colours which it is ſeen to aſſume, they are rather the effect of accident; for the ſame ſpecies of inſect does not at all times aſſume the ſame hue, when it becomes an aurelia. In ſome, the beautiful gold colour is at one time found; in others, it is wanting. This brilliant hue, which does not fall ſhort of the beſt gilding, is formed in the ſame manner in which we ſee leather obtain a gold colour, though none of that metal ever enters into the tincture. It is only formed by a beautiful brown varniſh, laid upon a white ground; and the white thus gleaming through the tranſparency of the brown, gives a charming golden yellow. Theſe two colours are found, one over the other, in the aurelia of the little animal we are deſcribing; and the whole appears gilded, without any real gilding.

The aurelia thus formed, and left to time to expand into a butterfly, in ſome meaſure reſembles an animal in an egg, that is to wait for external warmth to hatch it into life and vigour. As the quantity of moiſture that is encloſed within the covering of the aurelia, continues to keep its body in the moſt tender ſtate, ſo it is requiſite that this humidity ſhould be dried away, before the little butterfly can burſt its priſon. Many have been the experiments to prove that nature may in this reſpect be aſſiſted by art; and that the life of the inſect may be retarded or quickened, without doing it the ſmalleſt injury. For this purpoſe, it is only requiſite to continue the inſect in its aurelia ſtate, by preventing the evaporation of its humidity; which will conſequently add ſome days, nay weeks, to its life: on the other hand, by evaporating its moiſture, in a warm ſituation, the animal aſſumes its winged ſtate before its uſual time, and goes through the offices aſſigned its exiſtence. To prove this, Mr. Reaumur encloſed the aurelia in a glaſs tube; and found the evaporated water, which exhaled from the body of the inſect, collected in drops at the bottom of the tube: he covered the aurelia with varniſh; and this making the evaporation more difficult and ſlow, the butterfly was two months longer than its natural term, in coming out of its caſe: he found, on the other hand, that by laying the animal in a warm room, he haſtened the diſcloſure of the butterfly; and by keeping it in an ice-houſe in the ſame manner, he delayed it. Warmth acted, in this caſe, in a double capacity; invigorating the animal, and evaporating the moiſture.

The aurelia, though it bears a different external appearance, nevertheleſs contains within it all the parts of the butterfly in perfect formation; and lying each in a very orderly manner, though in the ſmalleſt compaſs. Theſe, however, are ſo faſt and tender, that it is impoſſible to viſit without diſcompoſing them. When either by warmth, or encreaſing vigour, the parts have acquired the neceſſary force and ſolidity, the butterfly then ſeeks to diſembarraſs itſelf of thoſe bands which kept it ſo long in confinement. Some inſects continue under the form of an aurelia not above ten days; ſome twenty; ſome ſeveral months; and even for a year together.

The butterfly, however, does not continue ſo long under the form of an aurelia, as one would be apt to imagine. In general, thoſe caterpillars that provide themſelves with cones, continue within them but a few days after the cone is completely finiſhed. Some, however, remain buried in this artificial covering for eight or nine months, without taking the ſmalleſt ſuſtenance during the whole time: and though in the caterpillar ſtate no animals were ſo voracious, when thus transformed, they appear a miracle of abſtinence. In all, ſooner or later, the butterfly burſts from its priſon; not only that natural priſon which is formed by the ſkin of the aurelia, but alſo from that artificial one of ſilk, or any other ſubſtance in which it has encloſed itſelf.

The efforts which the butterfly makes to get free from its aurelia ſtate, are by no means ſo violent as thoſe which the inſect had in changing from the caterpillar into the aurelia. The quantity of moiſture ſurrounding the butterfly is by no means ſo great as that attending its former change; and the ſhell of the aurelia is ſo dry, that it may be cracked between the fingers.

If the animal be ſhut up within a cone, the butterfly always gets rid of the natural internal ſkin of the aurelia, before it eats its way through the external covering which its own induſtry has formed round it. In order to obſerve the manner in which it thus gets rid of the aurelia covering, we muſt cut open the cone, and then we ſhall have an opportunity of diſcovering the inſect's efforts to emancipate itſelf from its natural ſhell. When this operation begins, there ſeems to be a violent agitation in the humours contained within the little animal's body. Its fluids ſeem driven, by an haſty fermentation, through all the veſſels; while it labours violently with its legs, and makes ſeveral other violent ſtruggles to get free. As all theſe motions concur with the growth of the inſect's wings and body, it is impoſſible that the brittle ſkin which covers it ſhould longer reſiſt: it at length gives way, by burſting in four diſtinct and regular pieces. The ſkin of the head and legs firſt ſeparates; then the ſkin at the back flies open, and dividing into two regular portions, diſengages the back and wings; then there likewiſe happens another rupture in that portion which covered the rings of the back of the aurelia. After this, the butterfly, as if fatigued with its ſtruggles, remains very quiet for ſome time, with its wings pointed downwards, and its legs fixed in the ſkin which it had juſt thrown off. At firſt ſight the animal, juſt ſet free, and permitted the future uſe of its wings, ſeem to want them entirely: they take up ſuch little room, that one would wonder where they were hidden. But ſoon after, they expand ſo rapidly, that the eye can ſcarce attend their unfolding. From reaching ſcarce half the length of the body, they acquire, in a moſt wonderful manner, their full extent and bigneſs, ſo as to be each five times larger than they were before. Nor is it the wings alone that are thus increaſed: all their ſpots and paintings, before ſo minute as to be ſcarce diſcernible, are proportionably extended; ſo that, what a few minutes before ſeemed only a number of confuſed, unmeaning points, now become diſtinct and moſt beautiful ornaments. Nor are are the wings, when they are thus expanded, unfolded in the manner in which earwigs and graſshoppers diſplay theirs, who unfurl them like a lady's fan: on the contrary, thoſe of butterflies actually grow to their natural ſize in this very ſhort ſpace. The wing, at the inſtant it is freed from its late confinement, is conſiderably thicker than afterwards; ſo that it ſpreads in all its dimenſions, growing thinner as it becomes broader. If one of the wings be plucked from the animal juſt ſet free, it may be ſpread by the fingers, and it will ſoon become as broad as the other, which has been left behind. As the wings extend themſelves ſo ſuddenly, they have not yet had time to dry; and accordingly appear like pieces of wet paper, ſoft, and full of wrinkles. In about half an hour, they are perfectly dry, their wrinkles entirely diſappear, and the little animal aſſumes all its ſplendor. The tranſmutation being thus perfectly finiſhed, the butterfly diſcharges three or four drops of a blood-coloured liquid, which are the laſt remains of its ſuperfluous moiſture. Thoſe aurelias which are encloſed within a cone, find their exit more difficult, as they have ſtill another priſon to break through: this, however, they perform in a ſhort time; for the butterfly, freed from its aurelia ſkin, butts with its head violently againſt the walls of its artificial priſon; and probably with its eyes, that are rough and like a file, it rubs the internal ſurface away; till it is at laſt ſeen burſting its way into open light; and, in leſs than a quarter of an hour, the animal acquires its full perfection.

Thus, to uſe the words of Swammerdam, we ſee a little inſignificant creature diſtinguiſhed, in its laſt birth, with qualifications and ornaments, which man, during his ſtay upon earth, can never even hope to acquire. The butterfly, to enjoy life, needs no other food but the dews of Heaven; and the honeyed juices which are diſtilled from every flower. The pageantry of princes cannot equal the ornaments with which it is inveſted; nor the rich colouring that embelliſhes its wings. The ſkies are the butterfly's proper habitation, and the air its element: whilſt man comes into the world naked, and often roves about without habitation or ſhelter; expoſed, on one hand, to the heat of the ſun; and, on the other, to the damps and exhalations of the earth; both alike enemies of his happineſs and exiſtence.—A ſtrong proof that, while this little animal is raiſed to its greateſt height, we are as yet, in this world, only candidates for perfection!

CHAP.

CHAP. III.

Of Butterflies and Moths.

IT has been already ſhewn that all Butterflies are bred from caterpillars; and we have exhibited the various circumſtances of that ſurpriſing change. It has been remarked, that butterflies may be eaſily diſtinguiſhed from flies of every other kind, by their wings; for, in others, they are either tranſparent, like gauze, as we ſee in the common fleſh fly; or they are hard and cruſted, as we ſee in the wings of the beetle. But in the butterfly, the wings are ſoft, opake, and painted over with a beautiful duſt, that comes off with handling.

The number of theſe beautiful animals is very great; and though Linnæus has reckoned up above ſeven hundred and ſixty different kinds, the catalogue is ſtill very incomplete. Every collector of butterflies can ſhew undeſcribed ſpecies: and ſuch as are fond of minute diſcovery, can here produce animals that have been examined only by himſelf. In general, however, thoſe of the warm climates are larger and more beautiful than ſuch as are bred at home; and we can eaſily admit the beauty of the

the butterfly, ſince we are thus freed from the damage of the caterpillar. It has been the amuſement of ſome to collect theſe animals, from different parts of the world; or to breed them from caterpillars at home. Theſe they arrange in ſyſtematic order; or diſpoſe ſo as to make ſtriking and agreeable pictures: and all muſt grant, that this ſpecious idleneſs is far preferable to that unhappy ſtate which is produced by a total want of employment.

The wings of butterflies, as was obſerved, fully diſtinguiſh them from flies of every other kind. They are four in number; and though two of them be cut off, the animal can fly with the two others remaining. They are, in their own ſubſtance, tranſparent; but owe their opacity to the beautiful duſt with which they are covered; and which has been likened, by ſome naturaliſts, to the feathers of birds; by others, to the ſcales of fiſhes; as their imaginations were diſpoſed to catch the reſemblance. In fact, if we regard the wing of a butterfly with a good microſcope, we ſhall perceive it ſtudded over with a variety of little grains of different dimenſions and forms, generally ſupported upon a footſtalk, regularly laid upon the whole ſurface. Nothing can exceed the beautiful and regular arrangement of theſe little ſubſtances;

which thus ſerve to paint the butterfly's wing, like the tiles of an houſe. Thoſe of one rank are a little covered by thoſe that follow: they are of many figures: on one part of the wing may be ſeen a ſucceſſion of oval ſtuds; on another part, a cluſter of ſtuds, each in the form of an heart: in one place they reſemble a hand open, and in another they are long or triangular; while all are interſperſed with taller ſtuds, that grow between the reſt, like muſhrooms upon a ſtalk. The wing itſelf is compoſed of ſeveral thick nerves, which render the conſtruction very ſtrong, though light; and though it be covered over with thouſands of theſe ſcales or ſtuds, yet its weight is very little encreaſed by the number. The animal is with eaſe enabled to ſupport itſelf a long while in air, although its flight be not very graceful. When it deſigns to fly to a conſiderable diſtance, it aſcends and deſcends alternately; going ſometimes to the right, ſometimes to the left, without any apparent reaſon. Upon cloſer examination, however, it will be found that it flies thus irregularly in purſuit of its mate; and as dogs bait and quarter the ground in purſuit of their game, ſo theſe inſects traverſe the air, in queſt of their mates, whom they can diſcover at more than a mile's diſtance.

If we proſecute our deſcription of the butterfly, the animal may be divided into three parts; the head, the corſelet, and the body.

The body is the hinder part of the butterfly, and is compoſed of rings, which are generally concealed under long hair, with which that part of the animal is cloathed. The corſelet is more ſolid than the reſt of the body, becauſe the fore wings, and the legs, are fixed therein. The legs are ſix in number, although four only are made uſe of by the animal; the two fore legs being often ſo much concealed in the long hair of the body, that it is ſometimes difficult to diſcover them. If we examine theſe parts internally, we ſhall find the ſame ſet of veſſels in the butterfly that we obſerved in the caterpillar, but with this great difference; that as the blood, or humours, in the caterpillar, circulated from the tail to the head, they are found, in the butterfly, to take a direct contrary courſe, and to circulate from the head to the tail; ſo that the caterpillar may be conſidered as the embryo animal, in which, as we have formerly ſeen, the circulation is carried on differently from what it is in animals when excluded.

But leaving the other parts of the butterfly, let us turn our attention particularly to the head. The eyes of butterflies have not all the ſame form; for, in ſome they are large, in others ſmall; in ſome they are the larger portion of a ſphere, in others they are but a ſmall part of it, and juſt appearing from the head. In all of them, however, the outward coat has a luſtre, in which may be diſcovered the various colours of the rainbow. When examined a little cloſely, it will be found to have the appearance of a multiplying glaſs; having a great number of ſides, or facets, in the manner of a brilliant cut diamond. In this particular, the eye of the butterfly, and of moſt other inſects, entirely correſpond; and Leuwenhoek pretends, there are above ſix thouſand facets on the cornea of a flea. Theſe animals, therefore, ſee not only with great clearneſs, but view every object multiplied in a ſurpriſing manner. Puget adapted the cornea of a fly in ſuch a poſition, as to ſee objects through it by the means of a microſcope; and nothing could exceed the ſtrangeneſs of its repreſentations: a ſoldier, who was ſeen through it, appeared like an army of pigmies; for while it multiplied, it alſo diminiſhed the object: the arch of a bridge exhibited a ſpectacle more magnificent than human ſkill could perform; the flame of a candle ſeemed a beautiful illumination. It ſtill, however, remains a doubt, whether the inſect ſees objects ſingly, as with one eye; or whether every facet is itſelf a complete eye, exhibiting its own object diſtinct from all the reſt.

Butterflies, as well as moſt other flying inſects, have two inſtruments, like horns, on their heads, which are commonly called feelers. They differ from the horns of greater animals, in being moveable at their baſe; and in having a great number of joints, by which means the inſect is enabled to turn them in every direction. Thoſe of butterflies are placed at the top of the head, pretty near the external edge of each eye. What the uſe of theſe inſtruments may be, which are thus formed with ſo much art, and by a Workman who does nothing without reaſon, is as yet unknown to man. They may ſerve to guard the eye; they may be of uſe to clean it; or they may be the organ of ſome ſenſe which we are ignorant of: but this is only explaining one difficulty by another.

We are not ſo ignorant of the uſes of the trunk, which few inſects of the butterfly kind are without. This inſtrument is placed exactly between the eyes; and when the animal is not employed in ſeeking its nouriſhment, it is rolled up, like a curl. A butterfly, when it is feeding, flies round ſome flower, and ſettles upon it.

The trunk is then uncurled, and thruſt out either wholly or in part; and is employed in ſearching the flower to its very bottom, let it be ever ſo deep. This ſearch being repeated ſeven or eight times, the butterfly then paſſes to another; and continues to hover over thoſe agreeable to its taſte, like a bird over its prey. This trunk conſiſts of two equal hollow tubes, nicely joined to each other, like the pipes of an organ.

Such is the figure and conformation of theſe beautiful inſects, that cheer our walks, and give us the earlieſt intimations of ſummer. But it is not by day alone that they are ſeen fluttering wantonly from flower to flower, as the greateſt number of them fly by night, and expand the moſt beautiful colouring at thoſe hours when there is no ſpectator. This tribe of inſects has therefore been divided into Diurnal and Nocturnal Flies; or, more properly ſpeaking, into Butterflies and Moths: the one only flying by day, the other moſt uſually on the wing in the night. They may be eaſily diſtinguiſhed from each other, by their horns or feelers: thoſe of the butterfly being clubbed, or knobbed at the end; thoſe of the moth, tapering finer and finer to a point. To expreſs it technically—the feelers of butterflies are clavated; thoſe of moths, are filiform.

The butterflies, as well as the moths, employ the ſhort life aſſigned them, in a variety of enjoyments. Their whole time is ſpent either in queſt of food, which every flower offers; or in purſuit of the female, whoſe approach they can often perceive at above two miles diſtance. Their ſagacity in this particular is not leſs aſtoniſhing than true; but by what ſenſe they are thus capable of diſtinguiſhing each other at ſuch diſtances, is not eaſy to conceive. It cannot be by the ſight, ſince ſuch ſmall objects as they are muſt be utterly imperceptible, at half the diſtance at which they perceive each other: it can ſcarcely be by the ſenſe of ſmelling, ſince the animal has no organs for that purpoſe. Whatever be their powers of perception, certain it is, that the male, after having fluttered, as if careleſſly, about for ſome time, is ſeen to take wing, and go forward, ſometimes for two miles together, in a direct line to where the female is perched on a flower.

The general rule among inſects is, that the female is larger than the male; and this obtains particularly in the tribe I am deſcribing. The body of the male is ſmaller and ſlenderer; that of the female, more thick and oval. Previous to the junction of theſe animals, they are ſeen ſporting in the air, purſuing and flying from each other, and preparing, by a mock combat, for the more important buſineſs of their lives. If they be diſturbed while united, the female flies off with the male on her back; who ſeems entirely paſſive upon the occaſion.

But the females of many moths and butterflies ſeem to have aſſumed their airy form for no other reaſon but to fecundate their eggs, and lay them. They are not ſeen fluttering about in queſt of food, or a mate: all that paſſes, during their ſhort lives, is a junction with the male of about half an hour; after which they depoſite their eggs, and die, without taking any nouriſhment, or ſeeking any. It may be obſerved, however, that in all the females of this tribe, they are impregnated by the male by one aperture, and lay their eggs by another.

The eggs of female butterflies are diſpoſed in the body like a bed of chaplets; which, when excluded, are uſually oval, and of a whitiſh colour: ſome, however, are quite round; and others flatted, like a turnip. The covering or ſhell of the egg, though ſolid, is thin and tranſparent; and in proportion as the caterpillar grows within the egg, the colours change, and are diſtributed differently. The butterfly ſeems very well inſtructed by nature in its choice of the plant, or the leaf, where it ſhall depoſite its burthen. Each egg contains but one caterpillar; and it is requiſite that this little animal, when excluded, ſhould be near its peculiar proviſion. The butterfly, therefore, is careful to place her brood only upon thoſe plants that afford good nouriſhment to its poſterity. Though the little winged animal has been fed itſelf upon dew, or the honey of flowers, yet it makes choice for its young of a very different proviſion, and lays its eggs on the moſt unſavoury plants; the rag-weed, the cabbage, or the nettle. Thus every butterfly chuſes not the plant moſt grateful to it in its winged ſtate; but ſuch as it has fed upon in its reptile form.

All the eggs of butterflies are attached to the leaves of the favourite plant, by a ſort of ſize or glue; where they continue, unobſerved, unleſs carefully ſought after. The eggs are ſometimes placed round the tender ſhoots of plants, in the form of bracelets, conſiſting of above two hundred in each, and generally ſurrounding the ſhoot, like a ring upon a finger. Some butterflies ſecure their eggs from the injuries of air, by covering them with hair, plucked from their own bodies, as birds ſometimes are ſeen to make their neſts; ſo that their eggs are thus kept warm, and alſo entirely concealed.

All the tribe of female moths lay their eggs a ſhort time after they leave the aurelia; but there are many butterflies that flutter about the whole ſummer, and do not think of laying, till the winter begins to warn them of their approaching end: ſome even continue the whole winter in the hollows of trees, and do not provide for poſterity until the beginning of April, when they leave their retreats, depoſite their eggs, and die. Their eggs ſoon begin to feel the genial influence of the ſeaſon: the little animals burſt from them in their caterpillar ſtate, to become aurelias, and butterflies in their turn; and thus to continue the round of nature.

CHAP. IV.

Of the Enemies of the Caterpillar.

NATURE, though it has rendered ſome animals ſurpriſingly fruitful, yet ever takes care to prevent their too great encreaſe. One ſet of creatures is generally oppoſed to another: and thoſe are chiefly the moſt prolific, that are, from their imbecility, incapable of making any effectual defence. The caterpillar has perhaps, of all other animals, the greateſt number of enemies; and ſeems only to exiſt, by its ſurpriſing fecundity. Some animals devour them by hundreds; others, more minute, yet more dangerous, mangle them in various ways: ſo that, how great ſoever their numbers may be, their deſtroyers are in equal proportion. Indeed, if we conſider the miſchiefs theſe reptiles are capable of occaſioning, and the various damages we ſuſtain from their inſatiable rapacity, it is happy for the other ranks of nature, that there are thouſands of fiſhes, birds, and even inſects, that live chiefly upon caterpillars, and make them their moſt favourite repaſt.

When we deſcribed the little birds that live in our gardens, and near our houſes, as deſtructive neighbours, ſufficient attention was not paid to the ſervices which they are frequently found to render us. It has been proved, that a ſingle ſparrow and its mate, that have young ones, deſtroy above three thouſand caterpillars in a week; not to mention ſeveral butterflies, in which numberleſs caterpillars are deſtroyed in embryo. It is in purſuit of theſe reptiles that we are favoured with the viſits of many of our moſt beautiful ſongſters; that amuſe us during their continuance, and leave us when the caterpillars diſappear.

The maxim which has often been urged againſt man, that he, of all other animals, is the only creature that is an enemy to his own kind, and that the human ſpecies only are found to deſtroy each other, has been adopted by perſons who never conſidered the hiſtory of inſects. Some of the caterpillar kind in particular, that ſeem fitted only to live upon leaves and plants, will, however, eat each other; and the ſtrongeſt will devour the weak, in preference to their vegetable food. That which lives upon the oak, is found to ſeize any of its companions, which it conveniently can, by the firſt rings, and inflict a deadly wound: it then feaſts in tranquility on its prey, and leaves nothing of the animal but the huſk.

But it is not from each other they have moſt to fear, as in general they are inoffenſive; and many of this tribe are found to live in a kind of ſociety. Many kind of flies lay their eggs either upon, or within their bodies; and as theſe turn into worms, the caterpillar is ſeen to nouriſh a ſet of inteſtine enemies within its body, that muſt ſhortly be its deſtruction: Nature having taught flies, as well as all other animals, the ſureſt methods of perpetuating their kind. "Towards the end of Auguſt," ſays Reaumur, "I perceived a little fly, of a beautiful gold "colour, buſily employed in the body of a "large caterpillar, of that kind which feeds "upon cabbage. I gently ſeparated that part "of the leaf on which theſe inſects were placed, "from the reſt of the plant, and placed it where "I might obſerve them more at my eaſe. The "fly, wholly taken up by the buſineſs in which "it was employed, walked along the cater-"pillar's body, now and then remaining fixed "to a particular ſpot. Upon this occaſion, I "perceived it every now and then dart a ſting, "which it carried at the end of its tail, into the "caterpillar's body, and then drew it out again, "to repeat the ſame operation in another place. "It was not difficult for me to conjecture the "buſineſs which engaged this animal ſo ear-

“ neſtly; its whole aim was to depoſite its eggs “ in the caterpillar's body; which was to ſerve “ as a proper retreat for bringing them to per“ fection. The reptile thus rudely treated, “ ſeemed to bear all very patiently, only mov“ ing a little when ſtung too deeply; which, “ however, the fly ſeemed entirely to diſregard. “ I took particular care to feed this caterpillar; “ which ſeemed to me to continue as voracious “ and vigorous as any of the reſt of its kind. “ In about ten or twelve days, it changed into “ an aurelia, which ſeemed gradually to decline, “ and died: upon examining its internal parts, “ the animal was entirely devoured by worms; “ which, however, did not come to perfection, “ as it is probable they had not enough to “ ſuſtain them within.”

What the French philoſopher perceived upon this occaſion, is every day to be ſeen in ſeveral of the larger kinds of caterpillars, whoſe bodies ſerve as a neſt to various flies, that very carefully depoſite their eggs within them. The large cabbage caterpillar is ſo ſubject to its injuries, that, at certain ſeaſons, it is much eaſier to find them with than without them. The ichneumon fly, as it is called, particularly infeſts theſe reptiles, and prevents their fecundity. This fly is of all others the moſt formidable to inſects of various kinds. The ſpider, that deſtroys the ant, the moth, and the butterfly, yet often falls a prey to the ichneumon; who purſues the robber to his retreat, and, deſpiſing his nets, tears him in pieces, in the very labyrinth he has made. This inſect, as redoubtable as the little quadrupede that deſtroys the crocodile, has received the ſame name; and from its deſtruction of the caterpillar tribe, is probably more ſerviceable to mankind. This inſect, I ſay, makes the body of the caterpillar the place for depoſiting its eggs; to the number of ten, fifteen, or twenty. As they are laid in thoſe parts which are not mortal, the reptile ſtill continues to live, and to feed, ſhewing no ſigns of being incommoded by its new gueſts. The caterpillar changes its ſkin; and ſometimes undergoes the great change into an aurelia: but ſtill the fatal intruders work within, and ſecretly devour its internal ſubſtance: ſoon after they are ſeen burſting through its ſkin, and moving away, in order to ſpin themſelve a covering, previous to their own little transformation. It is indeed aſtoniſhing ſometimes to ſee the number of worms, and thoſe pretty large, that thus iſſue from the body of a ſingle caterpillar, and eat their way through its ſkin: but it is more extraordinary ſtill, that they ſhould remain within the body, devouring its entrails, without deſtroying its life. The truth is they ſeem inſtructed by nature not to devour its vital parts; for they are found to feed only upon that fatty ſubſtance which compoſes the largeſt part of the caterpillar's body. When this ſurpriſing appearance was firſt obſerved, it was ſuppoſed that the animal thus gave birth to a number of flies, different from itſelf; and that the ſame caterpillar ſometimes bred an ichneumon, and ſometimes a butterfly: but it was not till after more careful inſpection, it was diſcovered, that the ichneumon tribe were not the caterpillar's offspring, but its murderers.

CHAP. V.

Of the Silkworm.

HAVING mentioned, in the laſt chapter, the damages inflicted by the caterpillar tribe, we now come to an animal of this kind, that alone compenſates for all the miſchief occaſioned by the reſt. This little creature, which only works for itſelf, has been made of the utmoſt ſervice to man; and furniſhes him with a covering more beautiful than any other animal can ſupply. We may declaim indeed againſt the luxuries of the times, when ſilk is ſo generally worn; but were ſuch garments to fail, what other arts could ſupply their deficiency?

Though ſilk was anciently brought in ſmall quantities to Rome, yet it was ſo ſcarce as to be ſold for its weight in gold; and was conſidered as ſuch a luxurious refinement in dreſs, that it was infamous for a man to appear in habits of which ſilk formed but half the compoſition. It was moſt probably brought among them from the remoteſt parts of the Eaſt; ſince it was, at the time of which I am ſpeaking, ſcarcely known even in Perſia.

Nothing can be more remote from the truth, than the manner in which their hiſtorians deſcribe the animal by which ſilk is produced. Pauſanias informs us, that ſilk came from the country of the Seres, a people of Aſiatic Scythia; in which place an inſect, as large as the beetle, but in every other reſpect reſembling a ſpider, was bred up for that purpoſe. They take great care, as he aſſures us, to feed and defend it from the weather; as well during the ſummer's heat, as the rigours of winter. This inſect, he obſerves, makes its web with its feet, of which it has eight in number. It is fed, for the ſpace of four years, upon a kind of paſte, prepared for it; and at the beginning of the fifth, it is ſupplied with the leaves of the green willow, of which it is particularly fond. It then feeds till it burſts with fat; after which they take out its bowels, which are ſpun into the beautiful manufacture ſo ſcarce and coſtly.

The real hiſtory of this animal was unknown among the Romans till the times of Juſtinian; and it is ſuppoſed, that ſilkworms were not brought into Europe till the beginning of the twelfth century; when Roger of Sicily brought workmen in this manufacture from Aſia Minor, after his return from his expedition to the Holy Land, and ſettled them in Sicily and Calabria. From theſe the other kingdoms of Europe learned this manufacture; and it is now one of the moſt lucrative carried on among the ſouthern provinces of Europe.

The ſilkworm is now very well known to be a large caterpillar, of a whitiſh colour, with twelve feet, and producing a butterfly of the moth kind. The cone on which it ſpins, is formed for covering it while it continues in the aurelia ſtate; and ſeveral of theſe, properly wound off, and united together, form thoſe ſtrong and beautiful threads, which is woven into ſilk. The feeding theſe worms, the gathering, the winding, and twiſting, and the weaving their ſilk, is one of the principal manufactures of Europe; and, as our luxuries encreaſe, ſeems every day to become more and more neceſſary to human happineſs.

There are two methods of breeding ſilkworms; for they may be left to grow, and remain at liberty upon the trees where they are hatched; or they may be kept in a place built for that purpoſe, and fed every day with freſh leaves. The firſt method is uſed in China, Tonquin, and other hot countries; the other is uſed in thoſe places where the animal has been artificially propagated, and ſtill continues a ſtranger. In the warm climates, the ſilkworm proceeds from an egg, which has been glued by the parent moth upon proper parts of the mulberry-tree, and which remains in that ſituation during the winter. The manner in which they are ſituated and fixed to the tree, keeps them unaffected by the influence of the weather; ſo that thoſe froſts which are ſevere enough to kill the tree, have no power to injure the ſilkworm.

The inſect never proceeds from the egg till Nature has provided it a ſufficient ſupply; and till the budding leaves are furniſhed, in ſufficient abundance, for its ſupport. When the leaves are put forth, the worms ſeem to feel the genial ſummons, and burſting from their little eggs, crawl upon the leaves, where they feed with a moſt voracious appetite. Thus they become larger by degrees; and after ſome months feeding, they lay, upon every leaf, ſmall bundles, or cones of ſilk, which appear like ſo many golden apples, painted on a fine green ground. Such is the method of breeding them in the Eaſt; and without doubt it is beſt for the worms, and leaſt troubleſome for the feeder of them. But it is otherwiſe in our colder European climates; the frequent changes of the weather, and the heavy dews of our evenings, render the keeping them all night expoſed, ſubject to ſo many inconveniences, as to admit of no remedy. It is true, that by the aſſiſtance of nets, they may be preſerved from the inſults of birds; but the ſevere cold weather, which often ſucceeds the firſt heats of ſummer, as well as the rain and high winds, will deſtroy them all: and, therefore, to breed them in Europe, they muſt be ſheltered and protected from every external injury.

For this purpoſe, a room is choſen, with a ſouth aſpect; and the windows are ſo well glazed, as not to admit the leaſt air: the walls are well built, and the planks of the floor exceeding cloſe, ſo as to admit neither birds nor mice, nor even ſo much as an inſect. In the middle there ſhould be four pillars erected, or four wooden poſts, ſo placed as to form a pretty large ſquare. Between theſe are different ſtories made with ozier hurdles; and under each hurdle there ſhould be a floor, with an upright border all round. Theſe hurdles and floors muſt hang upon pullies, ſo as to be placed, or taken down at pleaſure.

When the worms are hatched, ſome tender mulberry leaves are provided, and placed in the cloth or paper box in which the eggs were laid, and which are large enough to hold a great number. When they have acquired ſome ſtrength, they muſt be diſtributed on beds of mulberry leaves, in the different ſtories of the ſquare in the middle of the room, round which a perſon may freely paſs on every ſide. They will fix themſelves to the leaves, and afterwards to the ſticks of the hurdles, when the leaves are devoured. They have then a thread, by which they can ſuſpend themſelves on occaſion, to prevent any ſhock by a fall; but this is by no means to be conſidered as the ſilk which they ſpin afterwards in ſuch abundance. Care muſt be taken that freſh leaves be brought every morning, which muſt be ſtrewed very gently and equally over them; upon which the ſilk-worms will forſake the remainder of the old leaves, which muſt be carefully taken away, and every thing kept very clean; for nothing hurts theſe inſects ſo much as moiſture and uncleanlineſs. For this reaſon their leaves muſt be gathered when the weather is dry, and kept in a dry place, if it be neceſſary to lay in a ſtore. As theſe animals have but a ſhort time to live, they make uſe of every moment, and almoſt continually are ſpinning, except at thoſe intervals when they change their ſkins. If mulberry leaves be difficult to be obtained, the leaves of lettuce or holyoak will ſuſtain them: but they do not thrive ſo well upon their new diet; and their ſilk will neither be ſo copious, nor of ſo good a quality.

Though the judicious choice, and careful management of their diet, is abſolutely neceſſary, yet there is another precaution of equal importance, which is to give them air, and open their chamber windows, at ſuch times as the ſun ſhines warmeſt. The place alſo muſt be kept as clean as poſſible; not only the ſeveral floors that are laid to receive their ordure, but the whole apartments in general. Theſe things well obſerved, contribute greatly to their health and encreaſe.

The worm, at the time it burſts the ſhell, is extremely ſmall, and of a black colour; but the head is of a more ſhining black than the reſt of the body: ſome days after, they begin to turn whitiſh, or of an aſh-coloured grey. After the ſkin begins to grow too rigid, or the animal is ſtinted with it, the inſect throws it off, and appears cloathed a-new: it then becomes larger and much whiter, though it has a greeniſh caſt: after ſome days, which are more or leſs, according to the different heat of the climate, or to the quality of the food, it leaves off eating, and ſeems to ſleep for two days together: then it begins to ſtir, and put itſelf into violent motions, till the ſkin falls off the ſecond time, and is thrown aſide by the animal's feet. All theſe changes are made in three weeks or a month's time; after which it begins to feed once more, ſtill in its caterpillar form, but a good deal differing from itſelf before its change. In a few days time it ſeems to ſleep again; and, when it awakes, it again changes its cloathing, and continues feeding as before. When it has thus taken a ſufficiency of food, and it parts are diſpoſed for aſſuming the aurelia form, the animal forſakes, for the laſt time, all food and ſociety, and prepares itſelf a retreat to defend it from external injuries, while it is ſeemingly deprived of life and motion.

This retreat is no other than its cone, or ball of ſilk, which Nature has taught it to compoſe with great art; and within which it buries itſelf, till it aſſumes its winged form. This cone or ball is ſpun from two little longiſh kinds of bags that lie above the inteſtines, and are filled with a gummy fluid, of a marigold colour. This is the ſubſtance of which the threads are formed; and the little animal is furniſhed with a ſurpriſing apparatus for ſpinning it to the degree of fineneſs which its occaſions may require. This inſtrument in ſome meaſure reſembles a wire-drawer's machine, in which gold or ſilver threads are drawn to any degree of minuteneſs; and through this the animal draws its thread with great aſſiduity. As every thread proceeds from two gum bags, it is probable that each ſupplies its own; which, however, are united, as they proceed from the animal's body. If we examine the thread with a microſcope, it will be found that it is flatted on one ſide, and grooved along its length: from hence we may infer, that it is doubled juſt upon leaving the body; and that the two threads ſtick to each other by that gummy quality of which they are poſſeſſed. Previous to ſpinning its web, the ſilkworm ſeeks out ſome convenient place to erect its cell, without any obſtruction. When it has found a leaf, or a chink fitted to its purpoſe, it begins to wreathe its head in every direction, and faſtens its thread on every ſide to the ſides of its retreat. Though all its firſt eſſays ſeem perfectly confuſed, yet they are not altogether without deſign: there appears indeed, no order or contrivance in the diſpoſal of its firſt threads; they are by no means laid artfully over each other, but are thrown out at random, to ſerve as an external ſhelter againſt rain; for nature having appointed the animal to work upon trees in the open air, its habits remain, though it is brought up in a warm apartment.

Malpighi pretends to have obſerved ſix different layers in a ſingle cone of ſilk: but what may eaſily be obſerved is, that it is compoſed externally of a kind of rough cotton-like ſubſtance, which is called floſs; within the thread is more diſtinct and even; and next the body of the aurelia, the apartment ſeems lined with a ſubſtance of the hardneſs of paper, but of a much ſtronger conſiſtence. It muſt not be ſuppoſed, that the thread which goes to compoſe the cone, is rolled round, as we roll a bottom; on the contrary, it lies upon it in a very irregular manner, and winds off now from one ſide of the cone, and then from the other. This whole thread, if meaſured, will be found about three hundred yards long; and ſo very fine, that eight or ten of them are generally rolled off into one by the manufacturers. The cone, when completed, is in form like a pigeon's egg, and more pointed at one end than the other; at the ſmaller end, the head of the aurelia is generally found; and this is the place that the inſect, when converted into a moth, is generally ſeen to burſt through.

It is generally a fortnight or three weeks before the aurelia is changed into a moth; but no ſooner is the winged inſect completely formed, than having diveſted itſelf of its aurelia ſkin, it prepares to burſt through its cone, or outward priſon: for this purpoſe it extends its head towards the point of the cone, butts with its eyes, which are rough, againſt the lining of its cell, wears it away, and at laſt puſhes forward, through a paſſage which is ſmall at firſt, but which enlarges as the animal encreaſes its efforts for emancipation; while the tattered remnants of its aurelia ſkin lie in confuſion within the cone, like a bundle of dirty linen.

The animal, when thus ſet free from its double confinement, appears exhauſted with fatigue, and ſeems produced for no other purpoſe but to tranſmit a future brood. It neither flies nor eats; the male only ſeeking the female, whoſe eggs he impregnates; and their union continues for four days, without interruption. The male dies immediately after ſeparation from his mate; and ſhe ſurvives him only till ſhe has laid her eggs, which are not hatched into worms till the enſuing ſpring.

However, there are few of theſe animals ſuffered to come to a ſtate of maturity; for as their burſting through the cone deſtroys the ſilk, the manufacturers take care to kill the aurelia, by expoſing it to the ſun, before the moth comes to perfection. This done, they take off the floſs, and throw the cones into warm water, ſtirring them till the firſt thread offers them a clue for winding all off. They generally take eight of the ſilken threads together; the cones ſtill kept under water, till a proper quantity of the ſilk is wound off: however, they do not take all; for the latter parts grow weak, and are of a bad colour. As to the paper-like ſubſtance which remains, ſome ſtain it with a variety of colours, to make artificial flowers; others let it lie in the water, till the glutinous matter which cements it is all diſſolved: it is then carded like wool, ſpun with a wheel, and converted into ſilk ſtuffs of an inferior kind.

AN

HISTORY

OF THE FOURTH ORDER OF

INSECTS.

PART IV.

CHAP. I.

Of the Fourth Order of Inſects.

IN the foregoing part we treated of caterpillars changing into butterflies; in the preſent will be given the hiſtory of grubs changing into their correſponding winged animals. Theſe, like the former, undergo their transformation, and appear as grubs or maggots, as aurelias, and at laſt as winged inſects. Like the former, they are bred from eggs; they feed in their reptile ſtate; they continue motionleſs and lifeleſs, as aurelias; and fly and propagate, when furniſhed with wings. But they differ in many reſpects: the grub or maggot wants the number of feet which the caterpillar is ſeen to have; the aurelia is not ſo totally wrapped up, but that its feet and its wings appear. The perfect animal, when emancipated, alſo has its wings either caſed, or tranſparent, like gauze; not coloured with that beautifully painted duſt which adorns the wings of the butterfly.

In this claſs of inſects, therefore, we may place a various tribe, that are firſt laid as eggs, then are excluded as maggots or grubs, then change into aurelias, with their legs and wings not wrapped up, but appearing; and laſtly, aſſuming wings, in which ſtate they propagate their kind. Some of theſe have four tranſparent wings, as bees; ſome have two membranous caſes to their wings, as beetles; and ſome have but two wings, which are tranſparent, as ants. Here, therefore, we will place the bee, the waſp the humble bee, the ichneumon fly, the gnat, the tipula or longlegs, the beetle, the may-bug, the glow-worm, and the ant. The transformations which all theſe undergo, are pretty nearly ſimilar; and though very different animals in form, are yet produced nearly in the ſame manner.

CHAP. II.

Of the Bee.

TO give a complete hiſtory of this inſect in a few pages, which ſome have exhauſted volumes in deſcribing, and whoſe nature and properties ſtill continue in diſpute, is impoſſible. It will be ſufficient to give a general idea of the animal's operations; which, though they have been ſtudied for more than two thouſand years, are ſtill but incompletely known. The account given us by Reaumur is ſufficiently minute; and, if true, ſufficiently wonderful: but I find many of the facts which he relates, doubted by thoſe who are moſt converſant with bees; and ſome of them actually declared not to have a real exiſtence in nature.

It it unhappy, therefore, for thoſe whoſe method demands an hiſtory of bees, that they are unfurniſhed with thoſe materials which have induced ſo many obſervers to contradict ſo great a naturaliſt. His life was ſpent in the contemplation; and it requires an equal ſhare of attention, to prove the error of his diſcoveries. Without entering, therefore, into the diſpute, I will take him for my guide; and juſt mention, as I go along, thoſe particulars in which ſucceeding obſervers have begun to think him erroneous. Which of the two are right, time only can diſcover; for my part I have only heard one ſide, for as yet none have been ſo bold as openly to oppoſe Reaumur's delightful reſearches.

There are three different kinds of bees in every hive. Firſt, the labouring bees, which make up the far greateſt number, and are thought to be neither male or female, but merely born for the purpoſes of labour, and continuing the breed, by ſupplying the young with proviſion, while yet in their helpleſs ſtate. The ſecond ſort are the drones; they are of a darker colour, longer, and more thick by one third than the former: they are ſuppoſed to be the males; and there is not above a hundred of them, in a hive of ſeven or eight thouſand bees. the third ſort is much larger than either of the former, and ſtill fewer in number: ſome aſſert, that there is not above one in every ſwarm; but this later obſervers affirm not to be true, there being ſometimes five or ſix in the ſame hive. Theſe are called queen-bees, and are ſaid to lay all the eggs from which the whole ſwarm is hatched in a ſeaſon.

In examining the ſtructure of the common working bee, the firſt remarkable part that offers is the trunk, which ſerves to extract the honey from flowers. It is not formed, like that of other flies, in the manner of a tube, by which the fluid is to be ſucked up; but like a beſom, to ſweep, or a tongue, to lick it away. The animal is furniſhed alſo with teeth, which ſerve it in making wax. This ſubſtance is gathered from flowers, like honey; it conſiſts of that duſt or farina which contribute to the fecundation of plants, and is molded into wax by the little animal, at leiſure. Every bee, when it leaves the hive to collect this precious ſtore, enters into the cup of the flower, particularly ſuch as ſeem charged with the greateſt quantities of this yellow farina. As the animal's body is covered over with hair, it rolls itſelf within the flower, and ſoon becomes quite covered with the duſt, which it ſoon after bruſhes off with its two hind legs, and kneads into two little balls. In the thighs of the hind legs there are two cavities, edged with hair; and into theſe, as into a baſket, the animal ſticks its pellets. Thus employed, the bee flies from flower to flower, encreaſing its ſtore, and adding to its ſtock of wax; until the ball, upon each thigh, becomes as big as a grain of pepper: by this time, having got a ſufficient load, it returns, making the beſt of its way to the hive.

The belly of the bee is divided into ſix rings, which ſometimes ſhorten the body, by ſlipping one over the other. It contains within it, beſide the inteſtines, the honey-bag, the venom-bag, and the ſting. The honey-bag is as tranſparent as cryſtal, containing the honey that the bee has bruſhed from the flowers; of which the greater part is carried to the hive, and poured into the cells of the honey-comb; while the remainder ſerves for the bee's own nouriſhment: for, during ſummer, it never touches what has been laid up for the winter. The ſting, which ſerves to defend this little animal from its enemies, is compoſed of three parts; the ſheath, and two darts, which are extremely ſmall and penetrating. Both the darts have ſeveral ſmall points or barbs, like thoſe of a fiſh-hook, which renders the ſting more painful, and makes the darts rankle in the wound. Still, however, this inſtrument would be very ſlight, did not the bee poiſon the wound. The ſheath, which has a ſharp point, makes the firſt impreſſion; which is followed by that of the darts, and then the venomous liquor is poured in. The ſheath ſometimes ſticks ſo faſt in the wound, that the animal is obliged to leave it behind; by which the bee ſoon after dies, and the wound is conſiderably enflamed. It might at firſt appear well for mankind, if the bee were without its ſting; but, upon recollection, it will be found that the little animal would then have too many rivals in ſharing its labours. An hundred other lazy animals, fond of honey, and hating labour, would intrude upon the ſweets of the hive; and the treaſure would be carried off, for want of armed guardians to protect it.

From examining the bee ſingly, we now come to conſider it in ſociety, as an animal not only ſubject to laws, but active, vigilant, laborious, and diſintereſted. All its proviſions are laid up for the community; and all its arts in building a cell, deſigned for the benefit of poſterity. The ſubſtance with which bees build their cells is wax; which is faſhioned into convenient apartments for themſelves and their young. When they begin to work in their hives, they divide themſelves into four companies: one of which roves in the fields in ſearch of materials; another employs itſelf in laying out the bottom and partitions of their cells; a third is employed in making the inſide ſmooth from the corners and angles; and the fourth company bring food for the reſt, or relieve thoſe who return with their reſpective burthens. But they are not kept conſtant to one employment; they often change the taſks aſſigned them: thoſe that have been at work, being permitted to go abroad; and thoſe that have been in the fields already, take their places. They ſeem even to have ſigns, by which they underſtand each other; for when any of them wants food, it bends down its trunk to the bee from whom it is expected, which then opens its honey-bag, and lets ſome drops fall into the other's mouth, which is at that time opened to receive it. Their diligence and labour is ſo great, that, in a day's time, they are able to make cells, which lie upon each other, numerous enough to contain three thouſand bees.

If we examine their cells, they will be found formed in the exacteſt proportion. It was ſaid by Pappus, an ancient geometrician, that, of all other figures, hexagons were the moſt convenient; for, when placed touching each other, the moſt convenient room would be given, and the ſmalleſt loſt. The cells of the bees are perfect hexagons: theſe, in every honeycomb, are double, opening on either ſide, and cloſed at the bottom. The bottoms are compoſed of little triangular panes, which, when united together, terminate in a point, and lie exactly upon the extremities of other panes of the ſame ſhape, in oppoſite cells. Theſe lodgings have ſpaces, like ſtreets, between them, large enough to give the bees a free paſſage in and out; and yet narrow enough to preſerve the neceſſary heat. The mouth of every cell is defended by a border, which makes the door a little leſs than the inſide of the cell, which ſerves to ſtrengthen the whole. Theſe cells ſerve for different purpoſes: for laying up their young; for their wax, which in winter becomes a part of their food; and for their honey, which makes their principal ſubſiſtence.

It is well known that the habitation of bees ought to be very cloſe; and what their hives want, from the negligence or unſkilfulneſs of man, theſe animals ſupply by their own induſtry: ſo that it is their principal care, when firſt hived, to ſtop up all the crannies. For this purpoſe they make uſe of a reſinous gum, which is more tenacious than wax, and differs greatly from it. This the ancients called Propolis: it will grow conſiderably hard in June; though it will in ſome meaſure ſoften by heat; and is often found different in conſiſtence, colour, and ſmell. It has generally an agreeable aromatic odour when it is warmed; and by ſome it is conſidered as a moſt grateful perfume. When the bees begin to work with it, it is ſoft, but it acquires a firmer conſiſtence every day; till at length it aſſumes a brown colour, and becomes much harder than wax. The bees carry it on their hinder legs; and ſome think it is met with on the birch, the willow, and poplar. However it is procured, it is certain that they plaiſter the inſide of their hives with this compoſition.

If examined through a glaſs hive, from the hurry the whole ſwarm is in, the whole at firſt appears like anarchy and confuſion: but the ſpectator ſoon finds every animal diligently employed, and following one purſuit, with a ſettled purpoſe. Their teeth are the inſtruments by which they model and faſhion their various buildings, and give them ſuch ſymmetry and perfection. They begin at the top of the hive; and ſeveral of them work at a time, at the cells which have two faces. If they are ſtinted with regard to time, they give the new cells but half the depth which they ought to have; leaving them imperfect, till they have ſketched out the number of cells neceſſary for the preſent occaſion. The conſtruction of their combs, coſts them a great deal of labour: they are made by inſenſible additions; and not caſt at once in a mold, as ſome are apt to imagine. There ſeems no end of their ſhaping, finiſhing, and turning them neatly up The cells for their young are moſt carefully formed; thoſe deſigned for lodging the drones, are larger than the reſt;

and that for the queen-bee, the largeſt of all. The cells in which the young brood are lodged, ſerve at different times for containing honey; and this proceeds from an obvious cauſe: every worm, before it is transformed into an aurelia, hangs its old ſkin on the partitions of its cell; and thus, while it ſtrengthens the wall, diminiſhes the capacity of its late apartment. The ſame cell, in a ſingle ſummer, is often tenanted by three or four worms in ſucceſſion; and the next ſeaſon, by three or four more. Each worm takes particular care to fortify the pannels of its cell, by hanging up its ſpoils there: thus, the partitions being lined, ſix or eight deep, become at laſt too narrow for a new brood, and are converted into ſtore-houſes, for honey.

Thoſe cells where nothing but honey is depoſited, are much deeper than the reſt. When the harveſt of honey is ſo plentiful that they have not ſufficient room for it, they either lengthen their combs, or build more; which are much longer than the former. Sometimes they work at three combs at a time; for, when there are three work-houſes, more bees may be thus employed, without embarraſſing each other.

But honey, as was before obſerved, is not the only food upon which theſe animals ſubſiſt.

The meal of flowers, of which their wax is formed, is one of their moſt favourite repaſts. This is a diet which they live upon during the ſummer; and of which they lay up a large winter proviſion. The wax of which their combs are made, is no more than this meal digeſted, and wrought into a paſte. When the flowers upon which bees generally feed, are not fully blown, and this meal or duſt is not offered in ſufficient quantities, the bees pinch the tops of the ſtamina in which it is contained, with their teeth; and thus anticipate the progreſs of vegetation. In April and May, the bees are buſy, from morning to evening, in gathering this meal; but when the weather becomes too hot in the midſt of ſummer, they work only in the morning.

The bee is furniſhed with a ſtomach for its wax, as well as its honey. In the former of the two, their powder is altered, digeſted and concocted into real wax; and is thus ejected by the ſame paſſage by which it was ſwallowed. Every comb, newly made, is white: but it becomes yellow as it grows old, and almoſt black when kept too long in the hive. Beſide the wax thus digeſted, there is a large portion of the powder kneaded up for food in every hive, and kept in ſeparate cells, for winter proviſion, This is called, by the country people, bee-bread; and contributes to the health and ſtrength of the animal during winter. Thoſe who rear bees, may rob them of their honey, and feed them, during the winter, with treacle; but no proper ſubſtitute has yet been found for the bee-bread; and without it, the animals become conſumptive and die.

As for the honey, it is extracted from that part of the flower called the nectarium. From the mouth this delicious fluid paſſes into the gullet; and then into the firſt ſtomach, or honey-bag, which, when filled, appears like an oblong bladder. Children, that live in country places, are well acquainted with this bladder; and deſtroy many bees to come at their ſtore of honey. When a bee has ſufficiently filled its firſt ſtomach, it returns back to the hive, where it diſgorges the honey into one of the cells. It often happens that the bee delivers its ſtore to ſome other, at the mouth of the hive, and flies off for a freſh ſupply. Some honey-combs are always left open for common uſe; but many others are ſtopped up, till there is a neceſſity of opening them. Each of theſe are covered carefully with wax, ſo cloſe, that the covers ſeem to be made at the very inſtant the fluid is depoſited within them.

Having thus given a curſory deſcription of the inſect, individually conſidered, and of the habitation it forms, we next come to its ſocial habits and inſtitutions; and, in conſidering this little animal attentively, after the neceſſary precautions for the immediate preſervation of the community, its ſecond care is turned to the continuance of poſterity. How numerous ſoever the multitude of bees may appear in one ſwarm, yet they all owe their original to a ſingle parent, which is called the queen-bee. It is indeed ſurpriſing that a ſingle inſect ſhall, in one ſummer, give birth to above twenty thouſand young: but, upon opening her body, the wonder will ceaſe; as the number of eggs appearing, at one time, amounts to five thouſand. This animal, whoſe exiſtence is of ſuch importance to her ſubjects, may eaſily be diſtinguiſhed from the reſt, by her ſize, and the ſhape of her body. On her ſafety depends the whole welfare of the commonwealth; and the attentions paid her by all the reſt of the ſwarm, evidently ſhew the dependence her ſubjects have upon her ſecurity. If this inſect be carefully obſerved, ſhe will be ſeen at times attended with a numerous retinue, marching from cell to cell, plunging the extremity of her body into many of them, and leaving a ſmall egg in each.

The bees which generally compoſe her train, are thought to be males, which ſerve to impregnate her by turns. Theſe are larger and blacker than the common bees; without ſtings, and without induſtry. They ſeem formed only to tranſmit a poſterity; and to attend the queen, whenever ſhe thinks proper to iſſue from the ſecret retreats of the hive, where ſhe moſt uſually reſides. Upon the union of theſe two kinds depends all expectations of a future progeny; for the working bees are of no ſex, and only labour for another offspring: yet ſuch is their attention to their queen, that if ſhe happens to die, they will leave off working, and take no farther care of poſterity. If, however, another queen is in this ſtate of univerſal deſpair preſented them, they immediately acknowlege her for ſovereign, and once more diligently apply to their labour. It muſt be obſerved, however, that all this fertility of the queen-bee, and the great attentions paid to her by the reſt, are controverted by more recent obſervers. They aſſert, that the common bees are parents themſelves; that they depoſite their eggs in the cells which they have prepared; that the females are impregnated by the males, and bring forth a progeny, which is wholly their own.

However, to go on with their hiſtory, as delivered us by Mr. Reaumur—When the queen-bee has depoſited the number of eggs neceſſary in the cells, the working bees undertake the care of the riſing poſterity. They are ſeen to leave off their uſual employments; to conſtruct proper receptacles for eggs; or to complete thoſe that are already formed. They purpoſely build little cells, extremely ſolid, for the young; in which they employ a great deal of wax: thoſe deſigned for lodging the males, as was already obſerved, are larger than the reſt; and thoſe for the queen-bees the largeſt of all. There is uſually but one egg depoſited in every cell; but when the fecundity of the queen is ſuch, that it exceeds the number of cells already prepared, there are ſometimes three or four eggs crowded together in the ſame apartment. But this is an inconvenience that the working bees will by no means ſuffer. They ſeem ſenſible that, two young ones, ſtuffed up in the ſame cell, when they grow larger, will but embarraſs, and at laſt deſtroy each other: they therefore take care to leave a cell to every egg; and remove, or deſtroy the reſt.

The ſingle egg that is left remaining, is fixed to the bottom of the cell, and touches it but in a ſingle point. A day or two after it is depoſited, the worm is excluded from the ſhell of the egg, having the appearance of a maggot rolled up in a ring, and lying ſoftly on a bed of a whitiſh coloured jelly; upon which alſo the little animal begins to feed. In the mean time, the inſtant it appears, the working bees attend it with the moſt anxious and parental tenderneſs; they furniſh it every hour with a ſupply of this whitiſh ſubſtance, on which it feeds and lies; and watch the cell with unremitting care. They are nurſes that have a greater affection for the offspring of others, than many parents have for their own children. They are conſtant in viſiting each cell, and ſeeing that nothing is wanting; preparing the white mixture, which is nothing but a compoſition of honey and wax, in their own bowels, with which they feed them. Thus attended, and plentifully fed, the worm, in leſs than ſix days time, comes to its full growth, and no longer accepts the food offered it. When the bees perceive that it has no further occaſion for feeding, they perform the laſt offices of tenderneſs, and ſhut the little animal up in its cell; walling up the mouth of its apartment with wax: there they leave the worm to itſelf; having ſecured it from every external injury.

The worm is no ſooner left encloſed, but, from a ſtate of inaction, it begins to labour, extending and ſhortening its body; and by this means lining the walls of its apartment with a ſilken tapeſtry, which it ſpins in the manner of caterpillars, before they undergo their laſt transformation. When their cell is thus prepared, the animal is ſoon after transformed into an aurelia; but differing from that of the common caterpillar, as it exhibits not only the legs, but the wings of the future bee, in its preſent ſtate of inactivity. Thus, in about twenty, or one and twenty days after the egg was laid, the bee is completely formed, and fitted to undergo the fatigues of its ſtate. When all its parts have acquired their proper ſtrength and conſiſtence, the young animal opens its priſon, by piercing with its teeth the waxen door that confines it. When juſt freed from its cell, it is as yet moiſt, and incommoded with the ſpoils of its former ſituation; but the officious bees are ſoon ſeen to flock round it, and to lick it clean on all ſides with their trunks; while another band, with equal aſſiduity, are obſerved to feed it with honey: others again begin immediately to cleanſe the cell that has been juſt left; to carry the ordures out of the hive, and to fit the place for a new inhabitant. The young bee ſoon repays their care, by its induſtry; for as ſoon as ever its external parts become dry, it diſcovers its natural

tural appetites for labour, and induſtriouſly begins the taſk, which it purſues unremittingly through life. The toil of man is irkſome to him, and he earns his ſubſiſtence with pain; but this little animal ſeems happy in its purſuits, and finds delight in all its employments.

When juſt freed from the cell, and properly equipped by its fellow-bees for duty, it at once iſſues from the hive, and, inſtructed only by nature, goes in queſt of flowers, chuſes only thoſe that yield it a ſupply, rejects ſuch as are barren of honey, or have been already drained by other adventurers; and when loaded, is never at a loſs to find its way back to the common habitation. After this firſt ſally, it begins to gather the mealy powder that lies on every flower, which is afterwards converted into wax; and with this, the very firſt day, it returns with two large balls ſtuck to its thighs.

When bees firſt begin to break their priſons, there are generally above a hundred excluded in one day. Thus, in the ſpace of a few weeks, the number of the inhabitants in one hive, of moderate ſize, becomes ſo great, that there is no place to contain the new comers; and they are ſcarcely excluded from the cell, when they are obliged, by the old bees, to ſally forth in queſt of new habitations. In other words, the hive begins to ſwarm, and the new progeny prepares for exile.

While there is room enough in the hive, the bees remain quietly together; it is neceſſity alone that compels the ſeparation. Sometimes, indeed, the young brood, with graceleſs obſtinacy, refuſe to depart, and even venture to reſiſt their progenitors. The young ones are known by being browner than the old, with whiter hair; the old ones are of a lighter colour, with red hair. The two armies are therefore eaſily diſtinguiſhable, and dreadful battles are often ſeen to enſue. But the victory almoſt ever terminates with ſtrict poetical juſtice in favour of the veterans, and the rebellious offspring are driven off, not without loſs and mutilation.

In different countries, the ſwarms make their appearance at different times of the year, and there are ſeveral ſigns previous to this intended migration. The night before, an unuſual buzzing is heard in the hive; in the morning, though the weather be ſoft and inviting, they ſeem not to obey the call, being intent on more important meditations within. All labour is diſcontinued in the hive, every bee is either employed in forcing, or reluctantly yielding a ſubmiſſion; at length, after ſome noiſe and tumult, a queen bee is choſen, to guard, rather than conduct, the young colony to other habitations, and then they are marſhalled without any apparent conductor. In leſs than a minute, they leave their native abode, and forming a cloud round their protectreſs, they ſet off, without ſeeming to know the place of their deſtination; *The world before them, where to chuſe their place of reſt.* The uſual time of ſwarming, is from ten in the morning, to three in the afternoon, when the ſun ſhines bright, and invites them to ſeek their fortunes. They flutter for a while, in the air, like flakes of ſnow, and ſometimes undertake a diſtant journey, but more frequently are contented with ſome neighbouring aſylum; the branch of a tree, a chimney top, or ſome other expoſed ſituation. It is, indeed, remarkable, that all thoſe animals, of what ever kind, that have long been under the protection of man, ſeem to loſe a part of their natural ſagacity, in providing for themſelves. The rabbit, when domeſticated, forgets to dig holes, the hen to build a neſt, and the bee to ſeek a ſhelter, that ſhall protect it from the inclemencies of winter. In thoſe countries, where the bees are wild, and unprotected by man, they are always ſure to build their waxen cells in the hollow of a tree; but with us, they ſeem improvident in their choice, and the firſt green branch that ſtops their flight, ſeems to be thought ſufficient for their abode through winter. However, it does not appear that the queen chuſes the place where they are to alight, for many of the ſtragglers, who ſeem to be pleaſed with a particular branch, go and ſettle upon it; others are ſeen to ſucceed, and at laſt, the queen herſelf, when ſhe finds a ſufficient number there before her, goes to make it the place of her head-quarters. When the queen is ſettled, the reſt of the ſwarm ſoon follow; and, in about a quarter of an hour, the whole body ſeem to be at eaſe. It ſometimes is found, that there are two or three queens to a ſwarm, and the colony is divided into parties; but it moſt uſually happens, that one of theſe is more conſiderable than the other, and the bees by degrees, deſert the weakeſt, to take ſhelter under the moſt powerful protector. The deſerted queen does not long ſurvive this defeat; ſhe takes refuge under the new monarch, and is ſoon deſtroyed by her jealous rival. Till this cruel execution is performed, the bees never go out to work; and if there ſhould be a queen bee, belonging to the new colony, left in the old hive, ſhe always undergoes the fate of the former. However, it muſt be obſerved, that the bees never ſacrifice any of their queens, when the hive is full of wax and honey; for there is at that time, no danger in maintaining a plurality of breeders.

When the ſwarm is thus conducted to a place of reſt, and the policy of government is ſettled, the bees ſoon reſume their former labours. The making cells, ſtoring them with honey, impregnating the queen, making proper cells for the reception of the riſing progeny, and protecting them from external danger, employ their unceaſing induſtry. But ſoon after, and towards the latter end of ſummer, when the colony is ſufficiently ſtored with inhabitants, a moſt cruel policy enſues. The drone bees, which are (as has been ſaid) generally in a hive, to the number of a hundred, are marked for ſlaughter. Theſe, which had hitherto led a life of indolence and pleaſure, whoſe only employment was in impregnating the queen, and rioting upon the labours of the hive, without aiding in the general toil, now ſhare the fate of moſt voluptuaries, and fall a ſacrifice to the general reſentment of ſociety.

The working bees, in a body, declare war againſt them; and in two or three days time, the ground all round the hive is covered with their dead bodies. Nay, the working bees will even kill ſuch drones, as are yet in the worm ſtate, in the cell, and eject their bodies from the hive, among the general carnage.

When a hive ſends out ſeveral ſwarms in the year, the firſt is always the beſt, and the moſt numerous. Theſe having the whole ſummer before them, have the more time for making wax and honey, and conſequently their labours are the moſt valuable to the proprietor. Although the ſwarm chiefly conſiſts of the youngeſt bees, yet it is often found, that bees of all ages compoſe the multitude of emigrants, and it often happens, that bees of all ages are ſeen remaining behind. The number of them is always more conſiderable than that of ſome populous cities, for ſometimes upwards of forty thouſand are found in a ſingle hive. So large a body may well be ſuppoſed to work with great expedition; and in fact, in leſs than twenty-four hours, they will make combs above twenty inches long, and ſeven or eight broad. Sometimes they will half fill their hives with wax, in leſs than five days. In the firſt fifteen days, they are always found to make more wax than they do afterwards during the reſt of the year.

Such are the out-lines of the natural hiſtory of theſe animals, as uſually found in our own country. How they are treated, ſo as to produce the greateſt quantity of honey, belongs rather to the rural oeconomiſt, than the natural hiſtorian; volumes have been written on the ſubject, and ſtill more remains equally curious and new. One thing, however, it may be proper to obſerve, that a farm, or a country, may be over-ſtocked with bees; as with any other ſort of animal; for a certain number of hives always require a certain number of flowers to ſubſiſt on. When the flowers near home are rifled, then are theſe induſtrious inſects ſeen taking more extenſive ranges, but their abilities may be over taxed; and if they are obliged, in queſt of honey, to go too far from home, they are over-wearied in the purſuit, they are devoured by birds, or beat down by the winds and rain.

From a knowlege of this, in ſome parts of France and Piedmont, they have contrived, as I have often ſeen, a kind of floating bee-houſe.

They have on board one barge, threeſcore or an hundred bee-hives, well defended from the inclemeney of an accidental ſtorm; and with theſe, the owners ſuffer themſelves to float gently down the river. As the bees are continually chuſing their flowery paſture along the banks of the ſtream, they are furniſhed with ſweets before unrifled; and thus a ſingle floating bee-houſe, yields the proprietor a conſiderable income. Why a method ſimilar to this has never been adopted in England, where we have more gentle rivers, and more flowery banks, than in any other part of the world, I know not; certainly it might be turned to advantage, and yield the poſſeſſor a ſecure, though perhaps a moderate income.

Having mentioned the induſtry of theſe admirable inſects, it will be proper to ſay ſomething of the effects of their labour, of that wax and honey, which are turned by man to ſuch various uſes. Bees gather two kinds of wax, one coarſe and the other fine. The coarſer ſort is bitter, and with this, which is called *propolis*, they ſtop up all the holes and crevices of their hives. It is of a more reſinous nature than the fine wax, and is conſequently better qualified to reſiſt the moiſture of the ſeaſon, and preſerve the works warm and dry within. The fine wax is as neceſſary to the animals preſervation as the honey itſelf. With this they make their lodgings, with this they cover the cells of their young, and in this they lay up their magazines of honey. This is made, as has been already obſerved, from the duſt of flowers, which is carefully kneaded by the little inſect, then ſwallowed, and having undergone a kind of digeſtion, is formed into the cells, which anſwers ſuch a variety of purpoſes. To collect this, the animal rolls itſelf in the flower it would rob, and thus takes up the vegetable duſt with the hair of its body. Then carefully bruſhing it into a lump, with its fore paws it thruſts the compoſition into two cavities behind the thighs, which are made like ſpoons to receive the wax, and the hair that lines them, ſerves to keep it from falling.

As of wax, there are alſo two kinds of honey. The white and the yellow. The white is taken without fire from the honey-combs. The yellow is extracted by heat, and ſqueezed through bags, in a preſs. The beſt honey is new, thick, and granulated, of a clear tranſparent white colour, of a ſoft and aromatic ſmell, and of a ſweet lively taſte. Honey made in mountainous countries, is preferable to that of the valley. The honey made in the ſpring, is more highly eſteemed, than that gathered in ſummer, which laſt is ſtill more valuable than that of autumn, when the flowers begin to fade and loſe their fragrance.

The bees are nearly alike in all parts of the world, yet there are differences worthy our notice. In Guadaloupe, the bee is leſs by one half than the European, and more black and round. They have no ſting, and make their cells in hollow trees; where, if the hole they meet with is too large, they form a ſort of waxen houſe, of the ſhape of a pear, and in this they lodge and ſtore their honey, and lay their eggs. They lay up their honey in waxen veſſels, of the ſize of a pigeon's egg, of a black or deep violet colour; and theſe are ſo joined together, that there is no ſpace left between them. The honey never congeals, but is fluid, of the conſiſtence of oil, and the colour of amber. Reſembling theſe, there are found little black bees, without a ſting, in all the tropical climates; and though theſe countries are replete with bees, like our own, yet thoſe form the moſt uſeful and laborious tribe in that part of the world. The honey they produce, is neither ſo unpalatable, nor ſo ſurfeiting as ours; and the wax is ſo ſoft, that it is only uſed for medicinal purpoſes, it being never found hard enough to form into candles, as in Europe.

Of inſects that receive the name of bees, among us, there are ſeveral; which, however, differ very widely from that induſtrious ſocial race we have been juſt deſcribing. The HUMBLE-BEE is the largeſt of all this tribe, being as large as the firſt joint of one's middle finger. Theſe are ſeen in every field, and perched on every flower. They build their neſt in holes in the ground, of dry leaves, mixed with wax and wool, defended with moſs from the weather. Each humble-bee makes a ſeparate cell, about the ſize of a ſmall nutmeg, which is round and hollow, containing the honey in a bag. Several of theſe cells are joined together, in ſuch a manner, that the whole appears like a cluſter of grapes. The females, which have the appearance of waſps, are very few, and their eggs are laid in cells, which the reſt ſoon cover over with wax. It is uncertain whether they have a queen or not; but there is one much larger than the reſt, without wings, and without hair, and all over black, like poliſhed ebony. This goes and views all the works, from time to time, and enters into the cell, as if it wanted to ſee whether every thing was done right: in the morning, the young humble-bees are very idle, and ſeem not at all inclined to labour, till one of the largeſt, about ſeven o'clock, thruſts half its body from a hole, deſigned for that purpoſe, and ſeated on the top of the neſt, beats its wings for twenty minutes ſucceſſively, buzzing the whole time, till the whole colony is put in motion. The humble-bees gather honey, as well as the common bees; but it is neither ſo fine, nor ſo good, nor the wax ſo clean, or ſo capable of fuſion.

Beſides the bees already mentioned, there are various kinds among us, that have much the appearance of honey-makers, and yet make only wax. The Wood-Bee is ſeen in every garden. It is rather larger than the common queen-bee; its body of a blueiſh black, which is ſmooth and ſhining. It begins to appear at the approach of ſpring, and is ſeen flying near walls expoſed to a ſunny aſpect. This bee makes its neſt in ſome piece of wood, which it contrives to ſcoop and hollow for its purpoſe. This, however, is never done in trees that are ſtanding, for the wood it makes choice of is half rotten. The holes are not made directly forward, but turning to one ſide, and have an opening ſufficient to admit one's middle finger; from whence runs the inner apartment, generally twelve or fifteen inches long. The inſtruments uſed in boring theſe cavities, are their teeth; the cavity is uſually branched into three or four apartments; and in each of theſe they lay their eggs, to the number of ten or twelve, each ſeparate and diſtinct from the reſt: The egg is involved in a ſort of paſte, which ſerves at once for the young animal's protection and nouriſhment. The grown bees, however, feed upon ſmall inſects, particularly a louſe, of a reddiſh brown colour, of the ſize of a ſmall pin's head.

Mason-Bees make their cells with a ſort of mortar, made of earth, which they build againſt a wall that is expoſed to the ſun. The mortar, which at firſt is ſoft, ſoon becomes as hard as ſtone, and in this their eggs are laid. Each neſt contains ſeven or eight cells, an egg in every cell, placed regularly one over the other. If the neſt remains unhurt, or wants but little repairs, they make uſe of them the year enſuing: and thus they often ſerve three or four years ſucceſſively. From the ſtrength of their houſes, one would think theſe bees in perfect ſecurity, yet none are more expoſed than they. A worm with very ſtrong teeth, is often found to bore into their little fortifications, and devour their young.

The **Ground-Bee** builds its neſt in the earth, wherein they make round holes, five or ſix inches deep; the mouth being narrow, and only juſt ſufficient to admit the little inhabitant. It is amuſing enough, to obſerve the patience and aſſiduity with which they labour. They carry out all the earth, grain by grain, to the mouth of the hole, where it forms a little hillock, an Alps compared to the power of the artiſt by which it is raiſed. Sometimes the walks of a garden are found undermined by their labours; ſome of the holes running directly downward, others horizontally beneath the ſurface. They lay up in theſe cavities proviſions for their young, which conſiſt of a paſte that has the appearance of corn, and is of ſweetiſh taſte.

The LEAF-CUTTING BEES make their neſt and lay their eggs among bits of leaves, very artificially placed in holes in the earth, of about the length of a tooth-pick caſe. They make the bits of leaves of a roundiſh form, and with them line the inſide of their habitations. This tapeſtry is ſtill further lined by a reddiſh kind of paſte, ſomewhat ſweet or acid. Theſe bees are of various kinds; thoſe that build their neſts with cheſnut-leaves are as big as drones, but thoſe of the roſe-tree are ſmaller than the common bee.

The WALL-BEES are ſo called becauſe they make their neſts in walls, of a kind of ſilky membrane with which they fill up the vacuities between the ſmall ſtones which form the ſides of their habitation. Their apartment conſiſts of ſeveral cells, placed end to end, each in the ſhape of a woman's thimble. Though the web which lines this habitation is thick and warm, yet it is tranſparent and of a whitiſh colour. This ſubſtance is ſuppoſed to be ſpun from the animal's body; the male and females are of a ſize, but the former are without a ſting. To theſe varieties of the bee kind might be added ſeveral others which are all different in nature, but not ſufficiently diſtinguiſhed to excite curioſity.

CHAP.

CHAP. III.

Of the Waſp.

HOWEVER ſimilar many inſects may be in appearance, this does not imply a ſimilitude in their hiſtory. The bee and the waſp reſemble each other very ſtrongly, yet, in examining their manner and their duration, they differ very widely; the bee labours to lay up honey, and lives to enjoy the fruits of its induſtry; the waſp appears equally aſſiduous, but only works for poſterity, as the habitation is ſcarcely completed when the inhabitant dies.

The waſp is well known to be a winged inſect with a ſting. To be longer in proportion to its bulk than the bee, to be marked with bright yellow circles round its body, and to be the moſt ſwift and active inſect of all the fly kind, On each ſide of the mouth this animal is furniſhed with a long tooth, notched like a ſaw, and with theſe it is enabled to cut any ſubſtance, not omitting meat itſelf, and to carry it to its neſt. Waſps live like bees in community, and ſometimes ten or twelve thouſand are found inhabiting a ſingle neſt.

Of all other inſects the waſp is the moſt fierce, voracious, and moſt dangerous, when enraged. They are ſeen wherever fleſh is cutting up, gorging themſelves with the ſpoil, and then flying to their neſts with their reeking prey. They make war alſo on every other fly, and the ſpider himſelf dreads their approaches.

Every community among bees is compoſed of females or queens, drones or males, and neutral or working bees. Waſps have ſimilar occupations; the two firſt are for propagating the ſpecies, the laſt for nurſing, defending and ſupporting the riſing progeny. Among bees, however, there is ſeldom above a queen or two in a hive; among waſps there are above two or three hundred.

As ſoon as the ſummer begins to invigorate the inſect tribes, the waſps are the moſt of the number, and diligently employed either in providing proviſions for their neſt, if already made, or in making one, if the former habitation be too ſmall to receive the encreaſing community. The neſt is one of the moſt curious objects in natural hiſtory, and contrived almoſt as artificially as that of the bees themſelves. Their principal care is to ſeek out a hole that has been begun by ſome other animal, a field mouſe, a rat, or a mole to build their neſts in. They ſometimes build upon the plain, where they are ſure of the dryneſs of their ſituation, but moſt commonly on the ſide of a bank to avoid the rain or water that would otherwiſe annoy them. When they have choſen a proper place they go to work with wonderful aſſiduity. Their firſt labour is to enlarge and widen the hole, taking away the earth and carrying it off to ſome diſtance. They are perfectly formed for labour, being furniſhed with a trunk above their mouths, two ſaws on each ſide which play to the right and left againſt each other, and ſix ſtrong muſcular legs to ſupport them. They cut the earth into ſmall parcels with their ſaws, and carry it out with their legs or paws. This is the work of ſome days; and at length the outline of their habitation is formed, making a cavity of about a foot and an half every way. While ſome are working in this manner, others are roving the fields to ſeek out materials for their building. To prevent the earth from falling down and cruſhing their riſing city into ruin, they make a ſort of roof with their gluey ſubſtance, to which they begin to fix the rudiments of their building, working from the top downwards, as if they were hanging a bell; which, however at length they cloſe up at the bottom. The materials with which they build their neſts, are bits of wood and glue. The wood they get where they can from the rails and poſts which they meet with in the fields and elſewhere. Theſe they ſaw and divide into a multitude of ſmall fibres, of which they take up little bundles in their claws, letting fall upon them a few drops of gluey matter with which their bodies are provided, by the help of which they knead the whole compoſition into a paſte, which ſerves them in their future building. When they have returned with this to the neſt, they ſtick their load of paſte on that part where they make their walls and partitions; they tread it cloſe with their feet, and trowel it with their trunks, ſtill going backwards as they work. Having repeated this operation three or four times, the compoſition is at length flatted out until it becomes a ſmall leaf of a grey colour, much finer than paper, and of a pretty firm texture. This done the ſame waſp returns to the field to collect a ſecond load of paſte, repeating the ſame ſeveral times, placing layer upon layer, and ſtrengthening every partition in proportion to the wants or convenience of the general fabric. Other working waſps come quickly after to repeat the ſame operation, laying more leaves upon the former, till at length, after much toil, they have finiſhed the large roof which is to ſecure them from the tumbling in of the earth. This dome being finiſhed, they make another entrance to their habitation, deſigned either for letting in the warmth of the ſun, or for eſcaping in caſe one door be invaded by plunderers. Certain however it is, that by one of theſe they always enter, by the other they ſally forth to their toil; each hole being ſo ſmall that they can paſs but one at a time. The walls being thus compoſed, and the whole ſomewhat of the ſhape of a pear, they labour at their cells which they compoſe of the ſame paper-like ſubſtance that goes to the formation of the outſide works. Their combs differ from thoſe of bees, not leſs in the compoſition than the poſition which they are always ſeen to obtain. The honeycomb of the bee is edgeways with reſpect to the hive; that of the waſp is flat, and the mouth of every cell opens downwards. Thus is their habitation, contrived ſtory above ſtory, ſupported by ſeveral rows of pillars which give firmneſs to the whole building, while the upper ſtory is flat-roofed, and as ſmooth as the pavement of a room, laid with ſquares of marble. The waſps can freely walk upon theſe ſtories between the pillars to do whatever their wants require. The pillars are very hard and compact, being larger at each end than in the middle, not much unlike the columns of a building. All the cells of the neſt are only deſtined for the reception of the young, being replete with neither wax nor honey.

Each cell is like that of the bee, hexagonal; but they are of two ſorts, the one larger for the production of the male and female waſps, the other leſs for the reception of the working part of the community. When the females are impregnated by the males, they lay their eggs, one in each cell, and ſtick it in with a kind of gummy matter to prevent its falling out. From this egg proceed the inſect in its worm-ſtate, of which the old ones are extremely careful, feeding it from time to time till it becomes large and entirely fills up its cell. But the waſp community differs from that of the bee in this; that among the latter the working bees take the parental duties upon them, whereas among the waſps the females alone are permitted to feed their young, and to nurſe their riſing progeny. For this purpoſe the female waits with great patience till the working waſps have brought in their proviſions, which ſhe takes from them, and cuts into pieces. She then goes with great compoſure from cell to cell, and feeds every young one with her mouth. When the young worms have come to a certain ſize they leave off eating, and begin to ſpin a very fine ſilk, fixing the firſt end to the entrance of the cell, then turning their heads, firſt on one ſide, then on the other, they fix the thread to different parts, and thus they make a ſort of a door which ſerves to cloſe up the mouth of the cell. After this they diveſt themſelves of their ſkins after the uſual mode of transformation, the aurelia by degrees begins to emancipate itſelf from its ſhell: by little and little it thruſts out its legs and wings, and inſenſibly acquires the colour and ſhape of its parent.

The waſp thus formed, and prepared for depredation, becomes a bold, troubleſome, and dangerous inſect: there are no dangers which it will not encounter in purſuit of its prey, and nothing ſeems to ſatiate its gluttony. Though it can gather no honey of its own, no animal is more fond of ſweets. For this purpoſe it will purſue the bee and the humble-bee, deſtroy them with its ſting, and then plunder them of their honey-bag, with which it flies triumphantly loaded to its neſt to regale its young. Waſps are ever fond of making their neſts in the neighbourhood of bees, merely to have an opportunity of robbing their hives, and feaſting on the ſpoil. Yet the bees are not found always patiently ſubmiſſive to their tyranny, but fierce battles are ſometimes ſeen to enſue, in which the bees make up by conduct and numbers what they want in perſonal prowefs. When there is no honey to be hand, they ſeek for the beſt and ſweeteſt fruits, and they are never miſtaken in their choice. From the garden they fly to the city, to the grocers ſhops, and butchers ſhambles. They will ſometimes carry off bits of fleſh half as big as themſelves, which which they fly to their neſt for the nouriſhment of their brood. Thoſe who cannot drive them away, lay for them a piece of ox's liver, which being without fibres, they prefer to other fleſh; and whenever they are found, all other flies are ſeen to deſert the place immediately. Such is the dread with which theſe little animals impreſs all the reſt of the inſect tribes, which they ſeize and devour without mercy, that they vaniſh at their approach. Wherever they fly, like the eagle or the falcon, they form a deſert in the air around them. In this manner the ſummer is paſſed in plundering the neighbourhood, and rearing up their young; every day adds to their numbers; and from their ſtrength, agility, and indiſcriminate appetite for every kind of proviſion, were they as long lived as the bee, they would ſoon ſwarm upon the face of nature, and become the moſt noxious plague of man: but providentally their lives are meaſured to their miſchief, and they live but a ſingle ſeaſon.

While the ſummer heats continue, they are bold, voracious, and enterpriſing: but as the ſun withdraws, it ſeems to rob them of their courage and activity. In proportion as the cold encreaſes, they are ſeen to become more domeſtic; they ſeldom leave the neſt, they make but ſhort adventures from home, they flutter about in the noon-day heats, and ſoon after return chilled and feeble.

As their calamities encreaſe, new paſſions ſoon begin to take place; the care for poſterity no longer continues, and as the parents are no longer able to provide their growing progeny a ſupply, they take the barbarous reſolution of ſacrificing them all to the neceſſity of the times. In this manner, like a garriſon upon ſhort allowance, all the uſeleſs hands are deſtroyed; the young worms, which a little before they fed and protected with ſo much aſſiduity, are now butchered and dragged from their cells. As the cold encreaſes they no longer find ſufficient warmth in their neſts, which grow hateful to them, and they fly to ſeek it in the corners of houſes, and places that receive an artificial heat. But the winter is ſtill inſupportable; and, before, the new year begins, they wither and die; the working waſps firſt, the males ſoon following, and many of the females ſuffering in the general calamity. In every neſt, however, one or two females ſurvive the winter, and having been impregnated by the male during the preceding ſeaſon, ſhe begins in ſpring to lay her eggs in a little hole of her own contrivance. This bundle of eggs, which is cluſtered together like grapes, ſoon produces two worms which the female takes proper precaution to defend and ſupply, and theſe when hatched ſoon give aſſiſtance to the female, who is employed in hatching two more; theſe alſo gathering ſtrength, extricate themſelves out of the web that encloſed them, and become likewiſe aſſiſtants to their mother; fifteen days after, two more make their appearance; thus is the community every day encreaſing, while the female lays in every cell, firſt a male and then a female. Theſe ſoon after become breeders in turn, till, from a ſingle female, ten thouſand waſps are ſeen produced before the month of June. After the female has thus produced her progeny, which are diſtributed in different diſtricts, they aſſemble from all parts, in the middle of ſummer, and provide for themſelves the large and commodious habitation, which has been deſcribed above.

Such is the hiſtory of the ſocial waſp; but, as among bees, ſo alſo among theſe inſects, there are various tribes that live in ſolitude: theſe lay their eggs in a hole for the purpoſe, and the parent dies long before the birth of its offspring. In the principal ſpecies of the SOLITARY WASPS, the inſect is ſmaller than the working waſp of the ſocial kind. The filament, by which the corſelet is joined to the body, is longer and more diſtinctly ſeen, and the whole colour of the inſect is blacker than in the ordinary kinds. But it is not their figure, but the manners of this extraordinary inſect that claim our principal regard.

From the end of May to the beginning of July, this waſp is ſeen moſt diligently employed. The whole purpoſe of its life ſeems to be in contriving and fitting up a commodious apartment for its young one, which is not to ſucceed it till the year enſuing. For this end it is employed, with unwearied aſſiduity, in boring a hole into the fineſt earth ſome inches deep, but not much wider than the diameter of its own body. This is but a gallery leading to a wider apartment deſtined for the convenient lodgment of its young. As it always chuſes a gravelly ſoil to work in, and where the earth is almoſt as hard as ſtone itſelf, the digging and hollowing this apartment is an enterprize of no ſmall labour; for effecting its operations, this inſect is furniſhed with two teeth, which are ſtrong and firm, but not ſufficiently hard to penetrate the ſubſtance through which it is reſolved to make its way: in order therefore to ſoften that earth which it is unable to pierce, it is furniſhed with a gummy liquor which it emits upon the place, and which renders it more eaſily ſeparable from the reſt, and the whole becoming a kind of ſoft paſte is removed to the mouth of the habitation. The animal's proviſion of liquor in theſe operations is however ſoon exhauſted; and it is then ſeen either taking up water from ſome neighbouring flower or ſtream in order to ſupply the deficiency.

At length, after much toil, a hole ſome inches deep is formed, at the bottom of which is a large cavity; and to this no other hoſtile inſect would venture to find its way, from the length and the narrowneſs of the defile through which it would be obliged to paſs. In this the ſolitary waſp lays its egg, which is deſtined to continue the ſpecies; there the naſcent animal is to continue for above nine months, unattended and immured, and at firſt appearance the moſt helpleſs inſect of the creation. But when we come to examine, new wonders offer, no other inſect can boaſt ſo copiouſly luxurious a proviſion, or ſuch confirmed ſecurity.

As ſoon as the mother-waſp has depoſited her egg at the bottom of the hole, her next care is to furniſh it with a ſupply of proviſions, which may be offered to the young inſect as ſoon as it leaves the egg. To this end ſhe procures a number of little green worms, generally from eight to twelve, and theſe are to ſerve as food for the young one the inſtant it awakens into life. When this ſupply is regularly arranged and laid in, the old one then, with as much aſſiduity as it before worked out its hole, now cloſes the mouth of the paſſage; and thus leaving its young one immured in perfect ſecurity and in a copious ſupply of animal food, ſhe dies, ſatisfied with having provided for a future progeny.

When the young one leaves the egg it is ſcarcely viſible, and is ſeen immured among a number of inſects, infinitely larger than itſelf, ranged in proper order around it, which, however give it no manner of apprehenſion. Whether the parent, when she laid in the inſect proviſion, contrived to diſable the worms from reſiſtance, or whether they were at firſt incapable of any, is not known. Certain it is, that the young glutton feaſts upon the living ſpoil without any controul; his game lies at his hand, and he devours one after the other as the calls of appetite incite him. The life of the young animal is therefore ſpent in the moſt luxurious manner, till its whole ſtock of worms is exhauſted, and then the time of its transformation begins to approach; and then ſpinning a ſilken web, it continues fixed in its cell till the ſun calls it from its dark abode the enſuing ſummer.

The waſps of Europe are very miſchievous, yet they are innocence itſelf when compared to thoſe of the tropical climates, where all the inſect tribes are not only numerous, but large, voracious, and formidable. Thoſe of the Weſt Indies are thicker, and twice as long as the common bee; they are of a grey colour, ſtriped with yellow, and armed with a very dangerous ſting. They make their cells in the manner of a honey-comb, in which the young ones are hatched and bred. They generally hang their neſts by threads, compoſed of the ſame ſubſtance with the cells, to the branches of trees, and the eaves of houſes. They are ſeen every where in great abundance, deſcending like fruit, particularly pears, of which ſhape they are, and as large as one's head. The inſide is divided into three round ſtories, full of cells, each hexagonal, like thoſe of an honey-comb. In ſome of the iſlands, theſe inſects are ſo very numerous, that their neſts are ſtuck up in this manner, ſcarce two feet aſunder, and the inhabitants are in continual apprehenſion from their accidental reſentment. It ſometimes happens, that no precautions can prevent their attacks, and the pains of their ſting is almoſt inſupportable. Thoſe who have felt it think it more terrible than even that of a ſcorpion; the whole viſage ſwells, and the features are ſo disfigured, that a perſon is ſcarcely known by his moſt intimate acquaintance.

CHAP. IV.

Of the Ichneumon Fly.

EVERY rank of inſects, how voracious ſoever, have enemies that are terrible to them, and that revenge upon them the injuries done upon the reſt of the animated creation. The waſp, as we have ſeen, is very troubleſome to man, and very formidable to the inſect tribe; but the ichneumon fly (of which there are many varieties) fears not the waſp itſelf, it enters its retreats, plunders it habitations, and takes poſſeſſion of that cell for its own young, which the waſp had laboriouſly built for a dearer poſterity.

Though there are many different kinds of this inſect, yet the moſt formidable, and that beſt known, is called the common ichneumon, with four wings, like the bee, a long ſlender black body, and a three-forked tail, conſiſting of briſtles; the two outermoſt black, and the middlemoſt red. This fly receives its name from the little quadrupede, which is found to be ſo deſtructive to the crocodile, as it bears a ſtrong ſimilitude in its courage and rapacity.

Though this inſtrument is, to all appearance, ſlender and feeble, yet it is found to be a weapon of great force and efficacy. There is ſcarce any ſubſtance which it will not pierce; and, indeed, it is ſeldom ſeen but employed in penetration. This is the weapon of defence, this is employed in deſtroying its prey and ſtill more, by this the animal depoſits her eggs whereever ſhe thinks fit to lay them. As it is an inſtrument chiefly employed for this purpoſe, the male is unprovided with ſuch a ſting, while the female uſes it with great force and dexterity, brandiſhing it when caught, from ſide to ſide, and very often wounding thoſe who thought they held her with the greateſt ſecurity.

All the flies of this tribe are produced in the ſame manner, and owe their birth to the deſtruction of ſome other inſect, within whoſe body they have been depoſited, and upon whoſe vitals they have preyed, till they came to maturity. There is no inſect whatever, which they will not attack, in order to leave their fatal preſent in its body; the caterpillar, the gnat, and even the ſpider himſelf, ſo formidable to others, is often made the unwilling foſterer of this deſtructive progeny.

About the middle of ſummer, when other inſects are found in great abundance, the ichneumon

neumon is ſeen flying buſily about, and ſeeking proper objects upon whom to depoſe its progeny. As there are various kinds of this fly, ſo they ſeem to have various appetites. Some are found to place their eggs within the aurelia of ſome naſcent inſect, others place them within the neſt, which the waſp had curiouſly contrived for its own young; and as both are produced at the ſame time, the young of the ichneumon not only devours the young waſp, but the whole ſupply of worms, which the parent had carefully provided for its proviſion. But the greateſt number of the ichneumon tribe are ſeen ſettling upon the back of the caterpillar, and darting, at different intervals, their ſtings into its body. At every dart they depoſite an egg, while the wounded animal ſeems ſcarcely ſenſible of the injury it ſuſtains. In this manner they leave from ſix to a dozen of their eggs, within the fatty ſubſtance of the reptile's body, and then fly off to commit farther depredations. In the mean time the caterpillar thus irreparably injured, ſeems to feed as voraciouſly as before; does not abate of its uſual activity; and, to all, appearance, ſeems no way affected by the internal enemies that are preparing its deſtruction in their darkſome abode. But they ſoon burſt from their egg ſtate, and begin to prey upon the ſubſtance of their priſon. As they grow larger, they require a greater ſupply, till at laſt the animal, by whoſe vitals they are ſupported, is no longer able to ſuſtain them, but dies; its whole inſide being almoſt eaten away. It often happens, however, that it ſurvives their worm ſtate, and then they change into a chryſalis, encloſed in the caterpillar's body till the time of their delivery approaches, when they burſt their priſons, and fly away. The caterpillar, however, is irreparably deſtroyed, it never changes into a chryſalis, but dies ſhortly after, from the injuries it had ſuſtained.

Such is the hiſtory of this fly, which, though very terrible to the inſect tribe, fails not to be of infinite ſervice to mankind. The millions which it kills in a ſingle ſummer, are inconceivable; and without ſuch a deſtroyer, the fruits of the earth would only riſe to furniſh a banquet for the inſect race, to the excluſion of all the nobler ranks of animated nature.

CHAP. V.

Of the Ant.

THOUGH the number of two-winged flies be very great, and the naturaliſts have taken ſome pains to deſcribe their characters and varieties; yet there is ſuch a ſimilitude in their forms and manners, that in a work like this, one deſcription muſt ſerve for all. We now, therefore, come to a ſpecies of four-winged inſects, that are famous from all antiquity, for their ſocial and induſtrious habits, that are marked for their ſpirit of ſubordination, that are offered as a pattern of parſimony to the profuſe, and of unremitting diligence to the ſluggard.

In the experiments, however, which have been more recently made, and the obſervations which have been taken, much of their boaſted frugality and precaution ſeems denied them; the treaſures they lay up, are no longer ſuppoſed, intended for future proviſion; and the choice they make in their ſtores, ſeems no way dictated by wiſdom. It is, indeed, ſomewhat ſurpriſing, that almoſt every writer of antiquity, ſhould deſcribe this inſect, as labouring in the ſummer, and feaſting upon the produce during the winter. Perhaps, in ſome of the warmer climates, where the winter is mild, and of ſhort continuance, this may take place; but in France and England theſe animals can have no manner of occaſion for a ſupply of winter proviſions, as they are actually in a ſtate of torpidity during that ſeaſon.

The common ants of Europe are of two or three different kinds; ſome red, ſome black, ſome with ſtings, and others without. Such as have ſtings, inflict their wounds in that manner; ſuch as are unprovided with theſe weapons of defence, have a power of ſpurting, from their hinder parts, an acid pungent liquor, which, if it lights upon the ſkin, inflames and burns it like nettles.

The body of an ant is divided, into the head, breaſt, and belly. In the head, the eyes are placed, which are entirely black, and under the eyes there are two ſmall horns or feelers, compoſed of twelve joints, all covered with a fine ſilky hair. The mouth is furniſhed with two crooked jaws, which project outwards, in each of which are ſeen inciſures, that look like teeth. The breaſt is covered with a fine ſilky hair, from which project ſix legs, that are pretty ſtrong and hairy, the extremities of each armed with two ſmall claws, which the animal uſes in climbing. The belly is more reddiſh than the reſt of the body, which is of a brown cheſnut colour, ſhining as glaſs, and covered with extremely fine hair,

From ſuch a formation, this animal ſeems bolder, and more active, for its ſize, than any other of the inſect tribe, and fears not to attack a creature, often above ten times its own magnitude.

As ſoon as the winter is paſt, in the firſt fine day in April, the ant hill, that before ſeemed a deſert, now ſwarms with new life, and myriads of theſe inſects are ſeen juſt awaked from their annual lethargy, and preparing for the pleaſures and fatigues of the ſeaſon. For the firſt day they never offer to leave the hill, which may be conſidered as their citadel, but run over every part of it, as if to examine its preſent ſituation, to obſerve what injuries it has ſuſtained during the rigours of winter, * while they ſlept, and to meditate and ſettle the labours of the day enſuing.

At the firſt diſplay of their forces, none but the wingleſs tribe appears, while thoſe furniſhed with wings remain at the bottom. Theſe are the working ants, that firſt appear, and that

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* Memoires pour ſervir à l' Hiſtoire des Inſectes par Charles de Geer.

are always deſtitute of wings; the males and females, that are furniſhed with four large wings each, are more ſlow in making their appearance.

Thus, like bees, they are divided into males, females, and the neutral or the working tribe. Theſe are all eaſily diſtinguiſhed from each other; the females are much larger than the males; the working ants are the ſmalleſt of all. The two former have wings; which, however, they ſometimes are diveſted of; the latter never have any, and upon them are devolved all the labours that tend to the welfare of the community. The female, alſo, may be diſtinguiſhed, by the colour and ſtructure of her breaſt, which is a little more brown than that of the common ant, and a little brighter than that of the male.

In eight or ten days after their firſt appearance, the labours of the hill are in ſome forwardneſs; the males and females are ſeen mixed with the working multitude, and purſued or purſuing each other. They ſeem no way to partake in the common drudgeries of the ſtate; the males purſue the females with great aſſiduity, and in a manner, force them to compliance. They remain coupled for ſome time, while the males thus united, ſuffer themſelves to be drawn along by the will of their partners.

In the mean time, the working body of the ſtate take no part in their pleaſures; they are ſeen diligently going from the ant-hill, in purſuit of food for themſelves and their aſſociates, and of proper materials for giving a comfortable retreat to their young, or ſafety to their habitation. In the fields of England, ant-hills are formed with but little apparent regularity. In the more ſouthern provinces of Europe, they are conſtructed with wonderful contrivance, and offer a ſight highly worthy a naturaliſt's curioſity. Theſe are generally formed in the neighbourhood of ſome large tree and a ſtream of water. The one is conſidered by the animals, as the proper place for getting food; the other for ſupplying them with moiſture, which they cannot well diſpenſe with. The ſhape, of the ant-hill is that of a ſugar loaf, about three feet high, compoſed of various ſubſtances; leaves, bits of wood, ſand, earth, bits of gum, and grains of corn. Theſe are all united into a compact body, perforated with galleries down to the bottom, and winding ways within the body of the ſtructure. From this retreat to the water, as well as to the tree, in different directions, there are many paths worn by conſtant aſſiduity, and along theſe the buſy inſects are ſeen paſſing and re-paſſing continually; ſo that from May, or the beginning of June, according to the ſtate of the ſeaſon, they work continually, till the bad weather comes on.

The chief employment of the working ants, is in ſuſtaining not only the idlers at home, but alſo finding a ſufficiency of food for themſelves. They live upon various proviſions, as well of the vegetable as of the animal kind. Small inſects they will kill and devour; ſweets of all kinds they are particularly fond of. They ſeldom, however, think of their community, till they themſelves are firſt ſatiated. Having found a juicy fruit, they ſwallow what they can, and then tearing it in pieces, carry home their load. If they meet with an inſect above their match ſeveral of them will fall upon it at once, and having mangled it, each will carry off a part of the ſpoil. If they meet, in their excurſions, any thing that is too heavy for one to bear, and yet, which they are unable to divide, ſeveral of them will endeavour to force it along; ſome dragging and others puſhing. If any one of them happens to make a lucky diſcovery, it will immediately give advice to others; and then at once, the whole republic will put themſelves in motion. If in theſe ſtruggles, one of them happens to be killed, ſome kind ſurvivor will carry him off to a great diſtance, to prevent the obſtructions his body may give to the general ſpirit of induſtry.

But while they are thus employed in ſupporting the ſtate, in feeding abroad, and carrying in proviſions to thoſe that continue at home, they are not unmindful of poſterity. After a few days of fine weather, the female ants begin to lay their eggs, and thoſe are as aſſiduouſly watched and protected by the working ants, who take upon themſelves to ſupply whatever is wanting to the naſcent animal's convenience or neceſſity. They are carried, as ſoon as laid, to the ſafeſt ſituation, at the bottom of their hill, where they are carefully defended from cold and moiſture. We are not to ſuppoſe, that thoſe white ſubſtances which we ſo plentifully find in every ant-hill, are the eggs as newly laid. On the contrary, the ant's egg is ſo very ſmall, that, though laid upon a black ground, it can ſcarcely be diſcerned. The little white bodies we ſee, are the young animals in their maggot ſtate, endued with life, long ſince freed from the egg, and often involved in a cone, which it has ſpun round itſelf, like the ſilk worm. The real egg, when laid, if viewed through a microſcope, appears ſmooth, poliſhed and ſhining, while the maggot is ſeen compoſed of twelve rings, and is oftener larger than the ant itſelf.

It is impoſſible to expreſs the fond attachment which the working ants ſhew to their riſing progeny. In cold weather they take them in their mouths, but without offering them the ſmalleſt injury, to the very depths of their habitation, where they are leſs ſubject to the ſeverity of the ſeaſon. In a fine day they remove them, with the ſame care, nearer the ſurface, where their maturity may be aſſiſted by the warm beams of the ſun. If a formidable enemy ſhould come to batter down their whole habitation, and cruſh them by thouſands in the ruin, yet theſe wonderful inſects, ſtill mindful of their parental duties, make it their firſt care to ſave their offspring. They are ſeen running wildly about, and different ways, each loaded with a young one, often bigger than the inſect that ſupports it. I have kept, ſays Swammerdam, ſeveral of the working ants in my cloſet, with their young, in a glaſs filled with earth. I took pleaſure in obſerving, that in proportion as the earth dried on the ſurface, they dug deeper and deeper to depoſite their eggs; and when I poured water thereon, it was ſurpriſing to ſee with what care, affection, and diligence they laboured, to put their brood in ſafety, in the drieſt place. I have ſeen alſo, that when water has been wanting for ſeveral days, and when the earth was moiſtened after it a little, they immediately carried their young ones to have a ſhare, who ſeemed to enjoy and ſuck the moiſture.

When the young maggot is come to its full growth, the breaſt ſwells inſenſibly, it caſts its ſkin, and loſes all motion. All the members which were hidden before, then begin to appear, an aurelia is formed, which repreſents very diſtinctly, all the parts of the animal, though they are yet without motion, and as it were, wrapped up in ſwaddling-cloaths. When at length, the little inſect has paſſed through all its changes, and acquired its proper maturity, it burſts this laſt ſkin, to aſſume the form it is to retain ever after. Yet this is not done by the efforts of the little animal alone, for the old ones very aſſiduouſly break open, with their teeth, the covering in which it is encloſed. Without this aſſiſtance the aurelia would never be able to get free, as Mr. De Geer often found, who tried the experiment, by leaving the aurelia to themſelves. The old ones not only aſſiſt them, but know the very preciſe time for lending their aſſiſtance; for, if produced too ſoon, the young one dies of cold; if retarded too long, it is ſuffocated in its priſon.

When the female has done laying, and the whole brood is thus produced, her labours, as well as that of the male, become unneceſſary; and her wings, which ſhe had but a ſhort time before ſo actively employed, drop off. What becomes of her when thus diveſted of her ornaments is not well known, for ſhe is ſeen in the cells for ſome weeks after. The males, on the other hand, having no longer any occupation at home, make uſe of thoſe wings with which they have been furniſhed by nature, and fly away, never to return, or to be heard of more. It is probable they periſh with the cold, or are devoured by the birds, which are particularly fond of this petty prey.

In the mean time, the working ants having probably depoſed their queens, and being deſerted by the males, that ſerved but to clog the community, prepare for the ſeverity of the winter, and bury their retreats as deep in the earth as they conveniently can. It is now found that the grains of corn, and other ſubſtances with which they furniſh their hill, are only meant as fences to keep off the rigours of the weather, not as proviſions to ſupport them during its continuance. It is found generally to obtain, that every inſect that lives a year after it is come to it full growth, is obliged to paſs four or five months without taking any nouriſhment, and will ſeem to be dead all that time. It would be to no purpoſe therefore for ants to lay up corn for the winter, ſince they lie that time without motion, heaped upon each other, and are ſo far from eating, that they are utterly unable to ſtir. Thus what authors have dignified by the name of a magazine, appears to be no more than a cavity, which ſerves for a common retreat when the weather forces them to return to their lethargic ſtate.

What has been ſaid with exaggeration of the European ant, is however true, if aſſerted of thoſe of the tropical climates. They build an ant-hill with great contrivance and regularity, they lay up proviſions, and, as they probably live the whole year, they ſubmit themſelves to regulations entirely unknown among the ants of Europe.

Thoſe of Africa are of three kinds, the red, the green and the black; the latter are above an inch long, and in every reſpect a moſt formidable inſect. Their ſting produces extreme pain, and their depredations are ſometimes extremely deſtructive. They build an ant-hill of a very great ſize, from ſix to twelve feet high;

it is made of viſcous clay, and tapers into a pyramidal form. This habitation is conſtructed with great artifice; and the cells are ſo numerous and even, that a honey-comb ſcarce exceeds them in number and regularity.

The inhabitants of this edifice ſeem to be under a very ſtrict regulation. At the ſlighteſt warning they will ſally out upon whatever diſturbs them; and if they have time to arreſt their enemy, he is ſure to find no mercy. Sheep, hens, and even rats are often deſtroyed by theſe mercileſs inſects, and their fleſh devoured to the bone. No anatomiſt in the world can ſtrip a ſkeleton ſo cleanly as they; and no animal, how ſtrong ſoever, when they have once ſeized upon it, has power to reſiſt them.

It often happens that theſe inſects quit their retreat in a body, and go in queſt of adventures. “ During may ſtay,” ſays Smith, “ at Cape “ Corſe Caſtle, a body of theſe ants came to “ pay us a viſit in our fortification. It was “ about day-break when the advanced guard “ of this famiſhed crew entered the chapel, “ where ſome negroe ſervants were aſleep upon “ the floor. The men were quickly alarmed at “ the invaſion of this unexpected army, and “ prepared, as well as they could, for a de- “ fence. While the foremoſt battalion of in-

"ſects had already taken poſſeſſion of the place, "the rear-guard was more than a quarter of a "mile diſtant. The whole ground ſeemed "alive, and crawling with unceaſing deſtruc-"tion. After deliberating a few moments up-"on what was to be done, it was reſolved to "lay a large train of gunpowder along the path "they had taken; by this means millions were "blown to pieces, and the rear-guard perceiv-"ing the deſtruction of their leaders, thought "proper inſtantly to return, and make back to "their original habitation."

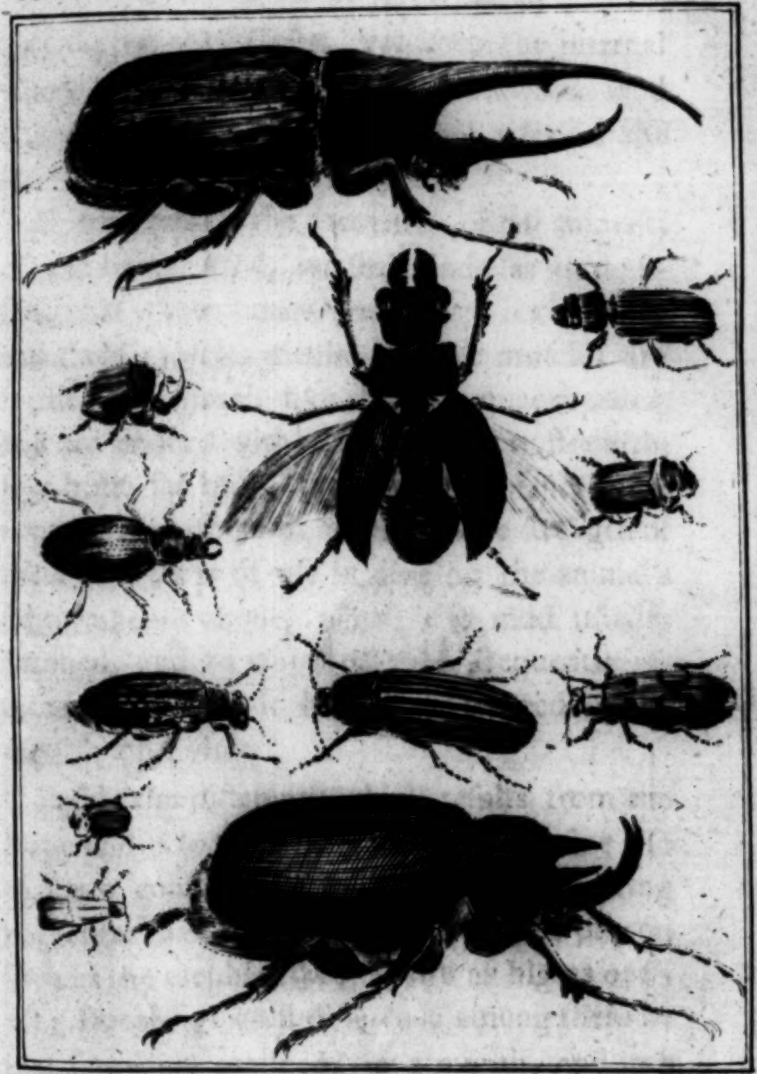
The order which theſe ants obſerve, ſeems very extraordinary; whenever they ſally forth, fifty or ſixty larger than the reſt are ſeen to head the band, and conduct them to their deſtined prey. If they have a fixed ſpot where their prey continues to reſort, they then form a vaulted gallery, which is ſometimes a quarter of a mile in length; and yet, they will hollow it out in the ſpace of ten or twelve hours.

CHAP. VI.

Of the Beetle and its Varieties.

HITHERTO we have been treating of inſects with four tranſparent wings, we now come to a tribe with two tranſparent wings, with caſes that cover them cloſe while at reſt, but which allow them their proper play when flying. The principal of theſe are the Beetle, the May Bug, and the Cantharis. Theſe are all bred like the reſt of their order, firſt from eggs, then they become grubs, then a chryſalis in which the parts of the future fly are diſtinctly ſeen, and laſtly the animal leaves its priſon, breaking forth as a winged animal in full maturity.

Of the Beetle there are various kinds; all, however, concurring in one common formation of having caſes to their wings, which are the more neceſſary to thoſe inſects, as they often live under the ſurface of the earth, in holes which they dig out by their own induſtry. Theſe caſes prevent the various injuries their real wings might ſuſtain, by rubbing or cruſhing againſt the ſides of their abode. Theſe, though



Beetles.

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BRITISH MUSEUM 9 OCT 48

they do not aſſiſt flight, yet keep the internal wings clean and even, and produce a loud buzzing noiſe, when the animal riſes in the air.

If we examine the formation of all animals, of the beetle kind, we ſhall find, as in ſhell-fiſh, that their bones are placed externally, and their muſcles within. Theſe muſcles are formed very much like thoſe of quadrupedes, and are endued with ſuch ſurpriſing ſtrength, that bulk for bulk, they are a thouſand times ſtronger than thoſe of a man. The ſtrength of theſe muſcles is of uſe in digging the animal's ſubterraneous abode, where it is moſt uſually hatched, and to which it moſt frequently returns, even after it becomes a winged inſect, capable of flying.

Beſide the difference which reſults from the ſhape and colour of theſe animals, the ſize alſo makes a conſiderable one; ſome beetles being not larger than the head of a pin, while others, ſuch as the elephant-beetle, are as big as one's fiſt: But the greateſt difference among them is, that ſome are produced in a month, and in a ſingle ſeaſon go through all the ſtages of their exiſtence, while others take near four years to their production; and live as winged inſects a year more. To give the hiſtory of all theſe animals, that are bred pretty much in the ſame way, would be inſipid and endleſs; it will ſuffice to ſelect one or two from the number, the origin of which may ſerve as ſpecimens of the reſt. I will, therefore, offer the hiſtory of the may-bug to the reader's attention; premiſing, that moſt other beetles, though not ſo long lived, are bred in the ſame manner.

The may-bug, or dorr-beetle, as ſome call it, has, like all the reſt, a pair of caſes to its wings, which are of a reddiſh brown colour, ſprinkled with a whitiſh duſt, which eaſily comes off. In ſome years their necks are ſeen covered with a red plate, and in others, with a black; theſe, however, are diſtinct ſorts, and their difference is by no means accidental. The fore legs are very ſhort, and the better calculated for burrowing in the ground, where this inſect makes its retreat. It is well known for its evening buzz to children; but ſtill more formidably introduced to the acquaintance of huſbandmen and gardeners, for in ſome ſeaſons, it has been found to ſwarm in ſuch numbers, as to eat up every vegetable production.

The two ſexes in the may-bug, are eaſily diſtinguiſhed from each other, by the ſuperior length of the tufts, at the end of the horns, in the male. They begin to copulate in ſummer, and at that ſeaſon, they are ſeen joined together for a conſiderable time. The female being impregnated, quickly falls to boring a hole into the ground, where to depoſit her burthen. This is generally about half a foot deep, and in it ſhe places her eggs, which are of an oblong ſhape, with great regularity, one by the other. They are of a bright yellow colour, and no way wrapped up in a common covering, as ſome have imagined. When the female is lightened of her burthen, ſhe again aſcends from her hole, to live as before, upon leaves and vegetables, to buzz in the ſummer evening, and to lie hid, among the branches of trees, in the heat of the day.

In about three months after theſe eggs have been thus depoſited in the earth, the contained inſect begins to break its ſhell, and a ſmall grub or maggot crawls forth, and feeds upon the roots of whatever vegetable it happens to be neareſt. All ſubſtances, of this kind, ſeem equally grateful, yet it is probable the mother inſect has a choice among what kind of vegetables ſhe ſhall depoſit her young. In this manner theſe voracious creatures continue in the worm ſtate, for more than three years, devouring the roots of every plant they approach, and making their way under ground, in queſt of food, with great diſpatch and facility. At length they grow to above the ſize of a walnut, being a great thick white maggot with a red head, which is ſeen moſt frequently in new turned earth, and which is ſo eagerly ſought after by birds of every ſpecies. When largeſt, they are found an inch and an half long, of a whitiſh yellow colour, with a body conſiſting of twelve ſegments or joints, on each ſide of which there are nine breathing holes, and three red feet. The head is large, in proportion to the body, of a reddiſh colour, with a pincer before, and a ſemi-circular lip, with which it cuts the roots of plants, and ſucks out their moiſture. As this inſect lives entirely under ground, it has no occaſion for eyes, and accordingly it is found to have none; but is furniſhed with two feelers, which, like the crutch of a blind man, ſerve to direct its motions. Such is the form of this animal, that lives for years in the worm ſtate under ground, ſtill voracious, and every year changing its ſkin.

It is not till the end of the fourth year, that this extraordinary inſect prepares to emerge from its ſubterraneous abode, and even this is not effected, but by a tedious preparation.

About the latter end of autumn, the grub begins to perceive the approach of its transformation, it then buries itſelf deeper and deeper in the earth, ſometimes ſix feet beneath the ſurface, and there forms itſelf a capacious apartment, the walls of which it renders very ſmooth and ſhining, by the excretions of its body. Its abode being thus formed, it begins ſoon after, to ſhorten itſelf, to ſwell, and to burſt its laſt ſkin, in order to aſſume the form of a chryſalis. This, in the beginning, appears of a yellowiſh colour, which heightens by degrees, till at laſt, it is ſeen nearly red. Its exterior form plainly diſcovers all the veſtiges of the future winged inſect, all the fore parts being diſtinctly ſeen; while behind, the animal ſeems as if wrapped in ſwaddling cloaths.

The young may-bug continues in this ſtate for about three months longer, and it is not till the beginning of January, that the aurelia diveſts itſelf of all its impediments, and becomes a winged inſect, completely formed. Yet ſtill the animal is far from attaining its natural ſtrength, health, and appetite. It undergoes a kind of infant imbecillity, and unlike moſt other inſects, that the inſtant they become flies are arrived at their ſtate of full perfection, the may-bug continues feeble and ſickly.

Its colour is much brighter than in the perfect animal, all parts are ſoft, and its voracious nature ſeems for a while, to have entirely forſaken it. As the animal is very often found in this ſtate, it is ſuppoſed, by thoſe unacquainted with its real hiſtory, that the old ones, of the former ſeaſon, have buried themſelves for the winter, in order to reviſit the ſun the enſuing ſummer. But the fact is, the old one never ſurvives the ſeaſon, but dies, like all the other winged tribe of inſects, from the ſeverity of cold in winter.

About the latter end of May, theſe inſects, after having lived for four years under ground, burſt from the earth, when the firſt mild evening invites them abroad. They are at that time ſeen riſing from their long impriſonment, from living only upon roots, and imbibing only the moiſture of the earth, to viſit the mildneſs of the ſummer air, to chuſe the ſweeteſt vegetables for their banquet, and to drink the dew of the evening, Wherever an attentive obſerver then walks abroad, he will ſee them burſting up before him in his pathway, like ghoſts on a theatre, He will ſee every part of the earth, that had its ſurface beaten into hardneſs, perforated by their egreſſion. When the ſeaſon is favourable for them, they are ſeen by myriads buzzing along, hitting againſt every object that intercepts their flight. The mid-day ſun, however, ſeems too powerful for their conſtitutions; they then lurk under the leaves and branches of ſome ſhady tree; but the willow ſeems particularly, their moſt favourite food; there they lurk in cluſters, and ſeldom quit the tree till they have devoured all its verdure. In thoſe ſeaſons, which are favourable to their propagation, they are ſeen in an evening as thick as flakes of ſnow, and hitting againſt every object with a ſort of capricious blindneſs. Their duration, however, is but ſhort, as they never ſurvive the ſeaſon. They begin to join ſhortly after they have been let looſe from their priſon, and when the female is impregnated, ſhe cautiouſly bores a hole in the ground, with an inſtrument fitted for that purpoſe, which ſhe is furniſhed with at the tail, and there depoſits her eggs, generally to the number of threeſcore. If the ſeaſon and the ſoil be adapted to their propagation, theſe ſoon multiply as already deſcribed, and go through the noxious ſtages of their contemptible exiſtence. This inſect, however, in its worm ſtate, though prejudicial to man, makes one of the chief repaſts of the feathered tribe, and is generally the firſt nouriſhment with which they ſupply their young. Rooks and hogs are particularly fond of theſe worms, and devour them in great numbers. The inhabitants of the county of Norfolk, ſome time ſince, went into the practice of deſtroying their rookeries, but in proportion, as they deſtroyed one plague, they were peſtered with a greater; and theſe inſects multiplied in ſuch an amazing abundance, as to deſtroy not only the verdure of the fields, but even the roots of vegetables, not yet ſhot forth. One farm in particular was ſo injured by them in the year 1751, that the occupier was not able to pay his rent; and the landlord was not only content to loſe his income for that year, but alſo gave money for the ſupport of the farmer and his family. In Ireland they ſuffered ſo much by theſe inſects, that they came to a reſolution of ſetting fire to a wood, of ſome miles in extent, to prevent their miſchievous propagation.

Of all the beetle kind this is the moſt numerous, and therefore deſerves the chief attention of hiſtory. The numerous varieties of other kinds might repay the curioſity of the diligent obſerver, but we muſt be content in general to obſerve, that in the great out-lines of the hiſtory, they reſemble thoſe of which we have juſt been giving a deſcription; like them, all other beetles are bred from the egg, which is depoſited in the ground, or ſometimes, though ſeldom, in the barks of trees, they change into a worm; they ſubſiſt in that ſtate by living upon the roots of vegetables, or the ſucculent parts of the bark round them. They generally live a year at leaſt before they change into an aurelia; in that ſtate they are not entirely motionleſs, nor intirely ſwaddled up without form.

It would be tedious and endleſs to give a deſcription of all, and yet it would be an unpardonable omiſſion not to mention the particularities of ſome beetles, which are ſingular rather from their ſize, their manners, or their formation. That beetle which the Americans call the tumble-dung, particularly demands our attention; it is all over of a duſky black, rounder than thoſe animals are generally found to be, and ſo ſtrong, though not much larger than the common black beetle, that if one of them be put under a braſs candleſtick, it will cauſe it to move backwards and forwards, as if it were by an inviſible hand, to the admiration of thoſe who are not accuſtomed to the ſight; but this ſtrength is given it for much more uſeful purpoſes than thoſe of exciting human curioſity, for there is no creature more laborious, either in ſeeking ſubſiſtence, or in providing a proper retreat for its young. They are endowed with ſagacity to diſcover ſubſiſtence by their excellent ſmelling, which directs them in flights to excrements juſt fallen from man or beaſt, on which they inſtantly drop, and fall unanimouſly to work in forming round balls or pellets thereof, in the middle of which they lay an egg. Theſe pellets, in September, they convey three feet deep in the earth, where they lye till the approach of ſpring when the eggs are hatched, the neſts burſt, and the inſects find their way out of the earth. They aſſiſt each other with indefatigable induſtry, in rolling theſe globular pellets to the place where they are to be buried. This they are to perform with the tail foremoſt, by raiſing up their hinder part, and ſhoving along the ball with their hind-feet. They are always accompanied with other beetles of a larger ſize, and of a more elegant ſtructure and colour. The breaſt of this is covered with a ſhield of a crimſon colour, and ſhining-like metal; the head is of the like colour, mixed witn green, and on the crown of the head ſtands a ſhining black horn, bended backwards. Theſe are called the kings of the beetles, but far what reaſon is uncertain, ſince they partake of the ſame dirty drudgery with the reſt.

The Elephant-beetle is the largeſt of this kind hitherto known, and is found in South-America, particularly Guiana and Surinam, as well as about the river Oroonoko. It is of a black colour, and the whole body is covered with a very hard ſhell, full as thick and as ſtrong as that of a ſmall crab. Its length, from the hinder part to the eyes, is almoſt four inches, and from the ſame part to the end of the proboſcis, or trunk, four inches and three quarters. The tranſverſe diameter of the body is two inches and a quarter, and the breadth of each elytron, or caſe for the wings, is an inch and three tenths. The antennæ or feelers, are quite horny; for which reaſon the proboſcis or trunk is moveable at its inſertion into the head, and ſeems to ſupply the place of feelers. The horns are eight tenths of an inch long, and terminate in points. The proboſcis is an inch and a quarter long, and turns upwards, making a crooked line, terminating in two horns, each of which is near a quarter of an inch long; but they are not perforated at the end like the proboſcis of other inſects. About four tenths of an inch above the head, or that ſide next the body, is a prominence, or ſmall horn, which if the reſt of the trunk were away, would cauſe this part to reſemble the horn of a rhinoceros. There is indeed a beetle ſo called, but then the horns or trunk has no fork at the end, though the lower horn reſembles this. The feet are all forked at the end, but not like lobſters claws.

To this claſs we may alſo refer the glow-worm, that little animal which makes ſuch a diſtinguiſhed figure in the deſcriptions of our poets. No two inſects can differ more than the male and female of this ſpecies from each other. The male is in every reſpect a beetle, having caſes to its wings, and riſing in the air at pleaſure; the female, on the contrary, has none, but is entirely a creeping inſect, and is obliged to wait the approaches of her capricious companion. The body of the female has eleven joints, with a ſhield breaſt-plate, the ſhape of which is oval; the head is placed over this, and is very ſmall, and the three laſt joints of her body are of a yellowiſh colour; but what diſtinguiſhes it from all other animals, at leaſt in this part of the world, is the ſhining light which it emits by night, and which is ſuppoſed by ſome philoſophers, to be an emanation which ſhe ſend forth to allure the male to her company. Moſt travellers who have gone through ſandy countries muſt well remember the little ſhining ſparks with which the ditches are ſtudded on each ſide of the road. If incited by curioſity to approach more nearly, he will find the light ſent forth by the glow-worm; if he ſhould keep the little animal for ſome time, its light continues to grow paler, and at laſt appears totally extinct: The manner in which this light is produced has hitherto continued inexplicable; it is probable the little animal is ſupplied with ſome electrical powers, ſo that by rubbing the joints of its body againſt each other, it thus ſupplies a ſtream of light which if it allures the male, as we are told, ſerves for very uſeful purpoſes.

The cantharis is of the beetle kind, from whence come cantharides, well known in the ſhops by the name of Spaniſh flies, and for their uſe in bliſters. They have feelers like briſtles, flexible caſes to the wings, a breaſt pretty plain, and the ſides of the belly wrinkled. Cantharides differ from each other in their ſize, ſhape, and colour, thoſe uſed in the ſhops alſo do the ſame. The largeſt in theſe parts are about an inch long, and as much in circumference, but others are not above three quarters of an inch. Some are of a pure azure colour, others of pure gold, and others again, have a mixture of pure gold and azure colours: but they are all very brilliant, and extremely beautiful. Theſe inſects, as is well known, are of the greateſt benefit to mankind, making a part in many medicines conducive to human preſervation. They are chiefly natives of Spain, Italy, and Portugal; but they are to be met with alſo about Paris in the ſummer time, upon the leaves of the aſh, the poplar, and the roſe-trees, and alſo among wheat, and in meadows. It is very certain that theſe inſects are fond of aſh leaves, inſomuch that they will ſometimes ſtrip one of theſe trees quite bare. Some affirm, that theſe flies delight in ſweet-ſmelling herbs, and it is very certain, that they are fond of honey-ſuckles, lilac, and wild-cherry ſhrubs; but ſome that have ſought after them declare, they never could find them on elder-trees, nut-trees, and among wheat. We are told, that the country people expect the return of theſe inſects every ſeven years. It is very certain, that ſuch a number of theſe inſects have been ſeen together in the air, that they appeared like ſwarms of bees; and that they have ſo diſagreeable a ſmell, that it may be perceived a great way off, eſpecially about ſun-ſet, though they are not ſeen at that time. This bad ſmell is a guide for thoſe who make it their buſineſs to catch them. When they are caught they dry them, after which they are ſo light, that fifty will hardly weigh a dram. Thoſe that gather them, tie them in a bag, or a piece of linnen cloth, that has been well worn, and then they kill them with the vapours of hot vinegar, after which they dry them in the ſun, and keep them in boxes. Theſe flies, thus dried, being chymically analyſed, yield a great deal of volatile cauſtic-ſalt, mixed with a little oil, phlegm, and earth. Cantharides are penetrating, corroſive, and applied to the ſkin, raiſe bliſters, from whence proceeds a great deal of ſeroſity. They are made uſe of both inwardly and outwardly. However it is ſomewhat ſtrange that the effects of theſe flies ſhould fall principally upon the urinary paſſages, for though ſome authors have endeavoured to account for this, we are ſtill in the dark, for all they have ſaid amounts to no more, than that they affect theſe parts in a manner which may be very learnedly deſcribed, but very obſcurely comprehended.

An inſect of great, though perhaps not equal uſe in medicine, is that which is known by the name of the kermes; it is produced in the excreſcence of an oak, called the berry-bearing ilex, and appears at firſt wrapt up in a membranaceous bladder, of the ſize of a pea, ſmooth and ſhining, of a browniſh red colour, and covered with a very fine aſh-coloured powder. This bag teems with a number of reddiſh eggs or inſects, which being rubbed with the fingers, pour out a crimſon liquor. It is only met with in warm countries in the months of May and June. In the month of April this inſect becomes of the ſize and ſhape of a pea, and its eggs ſome time after burſt from the womb, and ſoon turning worms, run about the branches and leaves of the tree. They are of two ſexes, and the females have been hitherto deſcribed; but the males are very diſtinct from the former, and are a ſort of ſmall flies like gnats, with ſix feet, of which the four forward are ſhort, and the two backward long, divided into four joints, and armed with three crooked nails. There are two feelers on the head, a line and a half long, which are moveable, ſtreaked and articulated. The tail, at the back part of the body, is half a line long, and forked. The whole body is covered with two tranſparent wings, and they leap about in the manner of fleas. The harveſt of the kermes is greater or leſs in proportion to the ſeverity of the winter, aad the women gather them before ſun-riſing, tearing them off with their nails; for fear there ſhould be any loſs from the hatching of the inſects. They ſprinkle them with vinegar, and lay them in the ſun to dry, where they acquire a red colour.

An inſect, perhaps, ſtill more uſeful than either of the former, is the cochineal, which has been very variouſly deſcribed by authors; ſome have ſuppoſed it a vegetable excreſcence from the tree upon which it is found; ſome have deſcribed it as a louſe, ſome as a bug, and ſome as a beetle. As they appear in our ſhops when brought from America, they are of an irregular ſhape, convex on one ſide, and a little concave on the other; but are both marked with tranſverſe ſtreaks or wrinkles. They are of a ſcarlet colour within, and without of a blackiſh red, and ſometimes of a white, reddiſh, or aſh-colour, which are accounted the beſt, and are brought to us from Mexico. The cochineal inſect is of an oval form, of the ſize of a ſmall pea, with ſix feet, and a ſnout or trunk. It brings forth its young alive, and is nouriſhed by ſucking the juice of the plant. Its body conſiſts of ſeveral rings, and when it is once fixed on the plant, it continues immoveable, being ſubject to no change. Some pretend there are two ſorts, the one domeſtic, which is beſt, and the other wild, that is of a vivid colour; however, they appear to be the ſame, only with this difference, that the wild feeds upon uncultivated trees, without any aſſiſtance, whereas the domeſtic is carefully at a ſtated ſeaſon, removed to cultivated trees, where it feeds upon a purer juice. Thoſe who take care of theſe inſects, place them on the prickly pear-plant in a certain order, and are very induſtrious in defending them from other inſects; for if any other kind come among them, they take care to bruſh them off with foxes tails. Towards the end of the year, when the rains and cold weather are coming on, which are fatal to theſe inſects, they take off the leaves or branches covered with cochineal, that have not attained their utmoſt degree of perfection, and keep them in their houſes till winter is paſt. Theſe leaves are very thick and juicy, and ſupply them with ſufficient nouriſhment, while they remain within doors. When the milder weather returns, and theſe animals are about to exclude their young, the natives make them neſts, like thoſe of birds, but leſs, of tree-moſs, or ſoft hay, or the down of cocoa nuts, placing twelve in every neſt. Theſe they fix on the thorns of the prickly pear-plant, and in three or four days time they bring forth their young, which leave their neſts in a few days, and creep upon the branches of the plant, till they find a proper place to reſt in, and take in their nouriſhment; and until the females are fecundated by the males, which, as in the former tribe, differ very widely, from the females being winged inſects, whereas the others only creep, and are at moſt ſtationary. When they are impregnated, they produce a new offspring, ſo that the propagator has a new harveſt thrice a year. When the native Americans have gathered the cochineal, they put them into holes in the ground, where they kill them with boiling water, and afterwards dry them in the ſun, or in an oven, or lay them upon hot plates. From the various methods of killing them, ariſe the different colours which they appear in when brought to us. While they are living, they ſeem to be ſprinkled over with a white powder, which they loſe as ſoon as the boiling water is poured upon them. Thoſe that are dried upon hot places are the blackeſt. What we call the cochineal are only the females, for the males are a ſort of fly, as already obſerved, in the kermes. They are uſed both for dyeing and medicine, and are ſaid to have much the ſame virtue as the kermes, though they are now ſeldom uſed alone, but are mixed with other things for the ſake of the colour.

I ſhall end this account of the beetle tribe with the hiſtory of an animal which cannot properly be ranked under this ſpecies, and yet which cannot be more methodically ranged under any other. This is the inſect that forms and reſides in the gall-nut, the ſpoils of which are converted to ſuch uſeful purpoſes. The gall inſects are bred in a ſort of bodies adhering to a kind of oak in Aſia, which differ with regard to their colour, ſize, roughneſs, ſmoothneſs and ſhape, and which we call galls. They are not fruit, as ſome have imagined, but preternatural tumours, owing to the wounds given to the buds, leaves, and twigs of the tree, by a kind of inſects that lay their eggs within them. This animal is furniſhed with an implement, by which the female penetrates into the bark of the tree, or into that ſpot which juſt begins to bud, and there ſheds a drop of corroſive fluid into the cavity. Having thus formed a receptacle for her eggs, ſhe depoſites them in the place, and dies ſoon after. The heart of the bud being thus wounded, the circulation of the nutritive juice is interrupted, and the fermentation thereof, with the poiſon injected by the fly, burns the parts adjacent, and then alters the natural colour of the plant. The juice or ſap turned back from its natural courſe, extravaſates and flows round the egg; after which it ſwells and dilates by the aſſiſtance of ſome bubbles of air, which get admiſſion through the pores of the bark, and which run in the veſſels with the ſap. The external coat of this excreſcence is dried by the air, and grows into a figure which bears ſome reſemblance to the bow of an arch, or the roundneſs of a kernel. This little ball receives its nutriment, growth and vegetation as the other parts of the tree, by ſlow degrees, and is what we call the gall-nut. The worm that is hatched under this ſpacious vault, finds in the ſubſtance of the ball, which is as yet very tender, a ſubſiſtence ſuitable to its nature; gnaws and digeſts it till the time comes for its transformation to a nymph, and from that ſtate of exiſtence changes into a fly. After this the inſect, perceiving itſelf duly provided with all things requiſite, diſengages itſelf ſoon from its confinement, and takes its flight into the open air. The caſe, however, is not ſimilar with reſpect to the gall-nut that grows in autumn. The cold weather frequently comes on before the worm is transformed into a fly, or before the fly can pierce through its incloſure. The nut falls with the leaves, and although you may imagine that the fly which lies within is loſt, yet in reality it is not ſo; on the contrary, its being covered up ſo cloſe, is the means of its preſervation. Thus it ſpends the winter in a warm houſe, where every crack and cranny of the nut is well ſtopped up; and lies buried as it were under a heap of leaves, which preſerves it from the injuries of the weather. This apartment, however, though ſo commodious a retreat in the winter, is a perfect priſon in the ſpring. The fly, rouzed out of its lethargy by the firſt heats, breaks its way through, and ranges where it pleaſes. A very ſmall aperture is ſufficient, ſince at this time the fly is but a diminutive creature. Beſides, the ringlets whereof its body is compoſed, dilate, and become pliant in the paſſage.

C H A P. VII.

Of the Gnat and the Tipula.

THERE are two inſects which entirely reſemble each other in their form, and yet widely differ in their habits, manners, and propagation. Thoſe who have ſeen the tipula, or long-legs, and the larger kind of gnat, have moſt probably miſtaken the one for the other; they have often accuſed the tipula, a harmleſs inſect, of depredations made by the gnat, and the innocent have ſuffered for the guilty; indeed the differences in their form are ſo very minute, that it often requires the aſſiſtance of a microſcope to diſtinguiſh the one from the other: they are both mounted on long legs, both furniſhed with two wings and a ſlender body; their heads are large, and they ſeem to be hump-bucked; the chief and only difference, therefore, is, that the tipula wants a trunk, while the gnat has a large one, which it often exerts to very miſchievous purpoſes. The tipula is a harmleſs, peaceful inſect, that offers injury to nothing; the gnat is ſanguinary and predaceous, ever ſeeking out for a place in which to bury its trunk, and pumping up the blood from the animal in large quantities.

The gnat proceeds from a little worm, which is uſually ſeen at the bottom of ſtanding waters. The manner in which the inſect lays its eggs is particularly curious; after having laid the proper number on the ſurface of the water, it ſurrounds them with a kind of unctuous matter, which prevents them from ſinking; but at the ſame time faſtens them with a thread to the bottom, to prevent their floating away, at the mercy of every breeze, from a place the warmth of which is proper for their production, to any other, where the water may he too cold, or the animals its enemies too numerous. Thus the inſects, in their egg ſtate, reſembles a buoy, which is fixed by an anchor. As they come to maturity they ſink deeper, and at laſt, when they leave the egg as worms, they creep at the bottom. They now make themſelves lodgments of cement, which they faſten to ſome ſolid body at the very bottom of the water, unleſs, by accident, they meet with a piece of chalk, which being of a ſoft and pliant nature, gives them an opportunity of ſinking a retreat for themſelves, where nothing but the claws of a cray-fiſh can poſſibly moleſt them. The worm afterwards changes its form. It appears with a large head, and a tail inveſted with hair, and moiſtened with an oleaginous liquor, which ſhe makes uſe of as a cork, to ſuſtain her head in the air, and her tail in the water, and to tranſport her from one place to another. When the oil with which her tail is moiſtened begins to grow dry, ſhe diſcharges out of her mouth an unctuous humour, which ſhe ſheds all over her tail, by virtue whereof, ſhe is enabled to tranſport herſelf where ſhe pleaſes, without being either wet or any ways incommoded by the water. The gnat, in her ſecond ſtate, is properly ſpeaking, in her form of a nymph, which is an introduction, or entrance into a new life. In the firſt place, ſhe diveſts herſelf of her ſecond ſkin; in the next ſhe reſigns her eyes, her antennæ, and her tail; in ſhort, ſhe actually ſeems to expire. However, from the ſpoils of the amphibious animal, a little winged inſect cuts the air, whoſe every part is active to the laſt degree, and whoſe whole ſtructure is the juſt object of our admiration. Its little head is adorned with a plume of feathers, and its whole body inveſted with ſcales and hair, to ſecure it from any wet or duſt. She makes trial of the activity of her wings, by rubbing them either againſt her body, or her broad ſide-bags, which keep her in an equilibrium. The furbelow, or little border of fine feathers, which graces her wings, is very curious, and ſtrikes the eye in the moſt agreeable manner. There is nothing, however, of greater importance to the gnat, than her trunk, and that weak implement may juſtly be deemed one of nature's maſter-pieces. It it ſo very ſmall, that the extremity of it can ſcarcely be diſcerned through the beſt microſcope that can be procured. That part which is at firſt obvious to the eye, is nothing but a long ſcaly ſheath under the throat. At near the diſtance of two thirds of it, there is an aperture, through which the inſect darts out four ſtings, and afterwards retracts them. One of which, however ſharp and active it may be, is no more than the caſe in which the other three lie concealed, and run in a long groove. The ſides of theſe ſtings are ſharpened like two-edged ſwords; they are likewiſe barbed, and have a vaſt number of cutting teeth towards the point, which turns up like a hook, and is fine beyond expreſſion. When all theſe darts are ſtuck into the fleſh of animals, ſometimes one after another, and ſometimes all at once, the blood and humours of the adjacent parts muſt unavoidably be extravaſated; upon which a tumour muſt conſequently enſue, the little orifice whereof is cloſed up by the compreſſion of the external air. When the gnat, by the point of her caſe, which ſhe makes uſe of as a tongue, has taſted any fruit, fleſh, or juice, that ſhe has found out; if it be a fluid, ſhe ſucks it up, without playing her darts into it; but in caſe ſhe finds the leaſt obſtruction by any fleſh whatever, ſhe exerts her ſtrength, and pierces through it, if poſſibly ſhe can. After this ſhe draws back her ſtings into their ſheath, which ſhe applies to the wound in order to extract, as through a reed, the juices which ſhe finds incloſed. This is the implement with which the gnat performs her work in the ſummer, for during the winter ſhe has no manner of occaſion for it. Then ſhe ceaſes to eat, and ſpends all that tedious ſeaſon either in quarries or in caverns, which ſhe abandons at the return of ſummer, and flies about in ſearch after ſome commodious ford, or ſtanding water, where ſhe may produce her progeny, which would be ſoon waſhed away and loſt, by the too rapid motion of any running ſtream. The little brood are ſometimes ſo numerous, that the very water is tinged according to the colour of the ſpecies, as green, if they be green, and of a ſanguine hue, if they be red.

Theſe are circumſtances ſufficiently extraordinary in the life of this little animal, but it offers ſomething ſtill more curious in the method of its propagation. However ſimilar inſects of the gnat kind are in their appearance, yet they differ widely from each other in the manner in which they are brought forth, for ſome are oviparous, and are produced from eggs, ſome are viviparous, and come forth in their moſt perfect form; ſome are males, and unite with the female; ſome are females, requiring the impregnation of the male; ſome are of neither ſex, yet ſtill produce young, without any copulation whatſoever. This is one of the ſtrangeſt diſcoveries in all natural hiſtory! A gnat ſeparated from the reſt of its kind, and incloſed in a glaſs veſſel, with air ſufficient to keep it alive, ſhall produce young, which alſo, when ſeparated from each other ſhall be the parents of a numerous progeny. Thus, down for five or ſix generations do theſe extraordinary animals propagate without the uſe of copulation, without any congreſs between the male and female, but in the manner of vegetables, the young burſting from the body of their parents, without any previous impregnation. At the ſixth generation, however, their propagation ſtops, the gnat no longer produces its like, from itſelf alone, but it requires the acceſs of the male to give it another ſucceſſion of fecundity.

The gnat of Europe gives but little uneaſineſs; it is ſometimes heard to hum about our beds at night, and keeps off the approaches of ſleep by the apprehenſion it cauſes; but it is very different in the ill-peopled regions of America, where the waters ſtagnate, and the climate is warm, and where they are produced in multitudes beyond expreſſion. The whole air is there filled with clouds of thoſe famiſhed inſects; and they are found of all ſizes, from ſix inches long, to a minuteneſs that even requires the microſcope to have a diſtinct perception of them. The warmth of the mid-day ſun is too powerful for their conſtitutions; but when the evening approaches, neither art nor flight can ſhield the wretched inhabitants from their attacks; tho' millions are deſtroyed, ſtill millions more ſucceed, and produce unceaſing torment. The native Indians, who anoint their bodies with oil, and who have from their infancy been uſed to their depredations, find them much leſs inconvenient than thoſe who are newly arrived from Europe; they ſleep in their cottages covered all over with thouſands of the gnat kind upon their bodies, and yet do not ſeem to have their ſlumbers interrupted by their cruel devourers. If a candle happens to be lighted in one of thoſe places, a cloud of inſects at once light upon the flame, and extinguiſh it; they are therefore obliged to keep their candles in glaſs lanthorns; a miſerable expedient to prevent an unceaſing calamity!

CHAP.

AN

HISTORY

OF THE

ZOOPHYTES.

PART V.

CHAP. VIII.

Of Zoophytes in General.

WE are now come to the laſt link in the chain of animated nature, to a claſs of beings ſo confined in their powers, and ſo defective in their formation, that ſome hiſtorians have been at a loſs whether to conſider them as a ſuperior rank of vegetables, or the humbleſt order of the animated tribe. In order therefore to give them a denomination, agreeable to their exiſtence, they have been called Zoophytes, a name implying vegetable nature indued with animal life; and, indeed, in ſome the marks of the animal are ſo few, that it is difficult to give their place in nature with preciſion, or to tell whether it is a plant or an inſect that is the object of our conſideration.

Should it be aſked what it is that conſtitutes the difference between animal and vegetable life, what it is that lays the line that ſeparates thoſe two great kingdoms from each other, it would be difficult, perhaps we ſhould find it impoſſible, to return an anſwer. The power of motion cannot form this diſtinction, ſince ſome vegetables are poſſeſt of motion, and many animals are totally without it. The ſenſitive plant has obviouſly a greater variety of motions than the oyſter or the pholas. The animal that fills the acorn-ſhell is immoveable, and can only cloſe its lid to defend itſelf from external injury, while the flower, which goes by the name of the fly-trap, ſeems to cloſe upon the flies that light upon it, and that attempt to rifle it of its honey. The animal in this inſtance, ſeems to have ſcarce a power of ſelf-defence; the vegetable not only guards its poſſeſſions, but ſeizes upon the robber that would venture to invade them. In like manner, the methods of propagation give no ſuperiority to the lower rank of animals. On the contrary, vegetables are frequently produced more conformably to the higher ranks of the creation, and though ſome plants are produced by cuttings from others, yet the general manner of propagation is from ſeeds, laid in the womb of the earth, where they are hatched into the ſimilitude of the parent plant or flower. But a moſt numerous tribe of animals have lately been diſcovered, which are propagated by cuttings, and this in ſo extraordinary a manner, that, though the original inſect be divided into a thouſand parts, each, however ſmall, ſhall be formed into an animal, entirely reſembling that which was at firſt divided; in this reſpect, therefore, certain races of animals ſeem to fall beneath vegetables, by their more imperfect propagation.

What, therefore, is the diſtinction between them, or are the orders ſo intimately blended as that it is impoſſible to mark the boundaries of each? To me it would ſeem, that all animals are poſſeſſed of one power, of which vegetables are totally deficient; I mean either the actual ability, or an aukward attempt at ſelf-preſervation. However vegetables may ſeem poſſeſſed of this important quality, yet it is with them but a mechanical impulſe, reſembling the raiſing one end of the lever, when you depreſs the other: the ſenſitive plant contracts and hangs its leaves, indeed, when touched, but this motion no way contributes to its ſafety; the fly-trap flower acts entirely in the ſame manner; and though it ſeems to ſeize the little animal, that comes to annoy it, yet, in reality, only cloſes mechanically upon it, and this incloſure neither contributes to its preſervation nor its defence. But it is very different with inſects, even of the loweſt order; the earth-worm not only contracts, but hides itſelf in the earth, and eſcapes with ſome ſhare of ſwiftneſs from its purſuers. The polypus hides its horns; the ſtar-fiſh contracts its arms, upon the appearance even of diſtant dangers; they not only hunt for their food, but provide for their ſafety, and however imperfectly they may be formed, yet ſtill they are in reality placed many degrees above the higheſt vegetable of the earth, and are poſſeſſed of many animal functions, as well as thoſe that are more elaborately formed.

But though theſe be ſuperior to plants, they are very far beneath their animated fellows of exiſtence. In the claſs of zoophytes, we may place all thoſe animals, which may be propagated by cuttings, or in other words, which, if divided into two or more parts, each part in time becomes a ſeparate and perfect animal; the head ſhoots forth a tail, and on the contrary, the tail produces a head; ſome of theſe will bear dividing, but into two parts, ſuch is the earth-worm; ſome may be divided into more than two, and of this kind are many of the ſtar-fiſh; others ſtill may be cut into a thouſand parts, each becoming a perfect animal; they may be turned inſide out, like the finger of a glove, they may be moulded into all manner of ſhapes, yet ſtill their vivacious principle remains, ſtill every ſingle part becomes perfect in its kind, and after a few days exiſtence, exhibits all the arts and induſtry of its contemptible parent! We ſhall, therefore, divide zoophytes according to their ſeveral degrees of perfection, namely, into worms, ſtar-fiſh, and polypi; contenting ourſelves with a ſhort review of thoſe nauſeous and deſpicable creatures, that excite our curioſity chiefly by their imperfections; it muſt not be concealed, however, that much has of late been written on this part of natural hiſtory. A new mode of animal production, could not fail of exciting not only the curioſity, but the aſtoniſhment of every philoſopher; many found their favourite ſyſtems totally overthrown by the diſcovery, and it was not without a wordy ſtruggle, that they gave up what had formerly been their pleaſure and their pride. At laſt, however, conviction became too ſtrong for argument, and a queſtion, which owed its general ſpread rather to its novelty, than to its importance, was given up in favour of the new diſcovery.

CHAP. IX.

Of Worms.

THE firſt in the claſs of zoophytes, are animals of the worm kind, which being entirely deſtitute of feet, trail themſelves along upon the ground, and find themſelves a retreat under the earth, or in the water. As theſe, like ſerpents, have a creeping motion, ſo both, in general, go under the common appellation of reptiles; a loathſome, noxious, malignant tribe, to which man by nature, as well as by religion, has the ſtrongeſt antipathy. But though worms, as well as ſerpents, are moſtly without feet, and have been doomed to creep along the earth on their bellies, yet their motions are very different. The ſerpent, as has been ſaid before, having a back bone, which it is incapable of contracting, bends its body into the form of a bow, and then ſhoots forward from the tail; but it is very different with the worm, which has a power of contracting or lengthening itſelf at will. There is a ſpiral muſcle, that runs round its whole body, from the head to tail, ſomewhat reſembling a wire wound round a walking-cane, which, when ſlipped off, and one end extended and held faſt, will bring the other nearer to it; in this manner the earth-worm, having ſhot out, or extended its body, takes hold by the ſlime of the fore part of its body, and ſo contracts and brings forward the hinder part; in this manner it moves onward, not without great effort, but the occaſions for its progreſſive motion are few.

As it is deſigned for living under the earth, and leading a life of obſcurity, ſo it ſeems tolerably adapted to its ſituation. Its body is armed with ſmall ſtiff ſharp burrs or prickles, which it can erect or depreſs at pleaſure; under the ſkin there lies a ſlimy juice, to be ejected as occaſion requires, at certain peforations, between the rings of the muſcles, to lubricate its body, and facilitate its paſſage into the earth. Like moſt other inſects, it hath breathing-holes along the back, adjoining each ring; but it is without bones, without eyes, without ears, and, properly without feet. It has a mouth, and alſo an alimentary canal, which runs along to the very point of the tail. In ſome worms, however, particularly ſuch as are found in the bodies of animals, this canal opens towards the middle of the belly, at ſome diſtance from the tail. The inteſtines of the earth-worm, are always found filled with a very fine earth, which ſeems to be the only nouriſhment theſe animals are capable of receiving.

The animal is entirely without brain, but near the head is placed the heart, which is ſeen to beat with a very diſtinct motion, and round it are the ſpermatic veſſels, forming a number of little globules, containing a milky fluid, which have an opening into the belly, not far from the head: they are alſo often found to contain a number of eggs, which are laid in the earth, and are hatched in twelve or fourteen days into life, by the genial warmth of their ſituation; like ſnails, all theſe animals unite in themſelves both ſexes at once, the reptile that impregnates, being impregnated in turn; few that walk out, but muſt have obſerved them, with their heads laid againſt each other, and ſo ſtrongly attached, that they ſuffer themſelves to be trod up.

When the eggs are laid in the earth, which, in about fourteen days, as has been ſaid, are hatched into maturity, the young ones come forth very ſmall, but perfectly formed, and ſuffer no change during their exiſtence: how long their life continues is not well known, but it certainly holds for more than two or three ſeaſons. During the winter, they bury themſelves deeper in the earth, and ſeem, in ſome meaſure, to ſhare the general torpidity of the inſect tribe. In ſpring, they revive with the reſt of nature, and on thoſe occaſions, a moiſt or dewy evening brings them forth from their retreats, for the univerſal purpoſe of continuing their kind. They chiefly live in a light rich and fertile ſoil, moiſtened by dews or accidental ſhowers, but avoid thoſe places where the water is apt to lie on the ſurface of the earth, or where the clay is too ſtiff for their eaſy progreſſion under ground.

Helpleſs as they are formed, yet they ſeem very vigilant in avoiding thoſe animals that chiefly make them their prey; in particular, the mole, who feeds entirely upon them beneath the ſurface, and who ſeldom ventures, from the dimneſs of its ſight, into the open air; him they avoid, by darting up from the earth, the inſtant they feel the ground move; and fiſhermen, who are well acquainted with this, take them in what numbers they chuſe, by ſtirring the earth where they expect to find them. They are alſo driven from their retreats under ground, by pouring bitter or acrid water thereon, ſuch as that water in which green walnuts have been ſteeped, or a lye made of pot-aſhes.

Such is the general outline of the hiſtory of theſe reptiles, which, as it ſhould ſeem, degrades them no way beneath the rank of other animals of the inſect creation; but we now come to a part of their hiſtory, which proves the imperfection of their organs, from the eaſineſs with which theſe little machines may be damaged and repaired again. It is well known in mechanics, that the fineſt and moſt complicated inſtruments are the moſt eaſily put out of order, and the moſt difficultly ſet right; the ſame alſo obtains in the animal machine. Man, the moſt complicated machine of all others, whoſe nerves are more numerous, and powers of action more various, is moſt eaſily deſtroyed: he is ſeen to die under wounds which a quadrupede or a bird could eaſily ſurvive; and as we deſcend gradually to the lower ranks, the ruder the compoſition, the more difficult it is to diſarrange it. Some animals live without their limbs, and often are ſeen to reproduce them; ſome are ſeen to live without their brain for many weeks together; caterpillars continue to increaſe and grow large, though all their nobler organs are intirely deſtroyed within; ſome animals continue to exiſt, though cut in two, their nobler parts preſerving life, while the others periſh that were cut away; but the earth worm, and all the zoophyte tribe, continue to live in ſeparate parts, and one animal, by the means of cutting, is divided into two diſtinct exiſtences, ſometimes into a thouſand.

There is no phænomenon in all natural hiſtory more aſtoniſhing than this, that man, at pleaſure, ſhould have a kind of creative power, and out of one life make two, each completely formed, with all its apparatus and functions, each with its perceptions, and powers of motion and ſelf-preſervation, each as complete in all reſpects as that from which it derived its exiſtence, and equally enjoying the humble gratifications of its nature.

When Des Cartes firſt ſtarted the opinion, that brutes were machines, the diſcovery of this ſurpriſing propagation was unknown, which might, in ſome meaſure, have ſtrengthened his fanciful theory. What is life, in brutes, he might have ſaid, or where does it reſide? In ſome we find it ſo diffuſed, that every part ſeems to maintain a vivacious principle, and the ſame animal appears poſſeſſed of a thouſand diſtinct irrational ſouls at the ſame time. But let us not, he would ſay, give ſo noble a name to ſuch contemptible powers, but rank the vivifying principle in theſe with the ſap that riſes in vegetables, or the moiſture that contracts a cord, or the heat that puts water into motion! Nothing, in fact, deſerves the name of ſoul, but that which reaſons, that which underſtands, and by knowing God, receives the mark of its currency, and is minted with the impreſſion of its great Creator.

Such might have been the ſpeculations of this philoſopher: however, to leave theory, it will be ſufficient to ſay that we owe the firſt diſcovery of this power of reproduction in animals to Mr. Trembley, who firſt obſerved it in the polypus, and after him, Spalanzani and others found it taking place in the earth-worm, the ſea-worm, and ſeveral other ill-formed animals of a like kind, which were ſuſceptible of this new mode of propagation. This laſt philoſopher, has tried ſeveral experiments upon the earth-worm, many of which ſucceeded according to his expectation; every earth-worm, however, did not retain the vivacious principle with the ſame obſtinacy; ſome, when cut in two, were intirely deſtroyed; others ſurvived only in the nobler part; and while the head was living the tail entirely periſhed, and a new one was ſeen to burgeon from the extremity. But what was moſt ſurpriſing of all, in ſome, particularly in the ſmall red-headed earth-worm, both extremities ſurvived the operation; the head produced a tail with the anus, the inteſtines, the annular muſcle, and the prickly beards; the tail part, on the other hand, was ſeen to ſhoot forth the nobler organs, and in leſs than the ſpace of three months ſent forth a head, heart, with all the apparatus and inſtruments of generation. This part, as may eaſily be ſuppoſed, was produced much more ſlowly than the former, a new head taking above three or four months for its completion, a new tail being ſhot forth in leſs than as many weeks. Thus two animals, by diſſection, we made out of one, each with their ſeparate appetites, each endued with life and motion, and ſeemingly as perfect as that ſingle animal from whence they derived their origin.

What was performed upon the earth-worm, was found to obain alſo in many other of the vermicular ſpecies. The ſea-worm, the white water-worm, and many of thoſe little worms with feelers, found at the bottom of dirty ditches; in all theſe the nobler organs are of ſuch little uſe, that if taken away, the animal does not ſeem to feel the want of them; it lives in all its parts, and in every part, and by a ſtrange paradox in nature, the moſt uſeleſs and contemptible life is of all others the moſt difficult to deſtroy.

CHAP.

CHAP. X.

Of the Star-fiſh.

THE next order of zoophytes is that of the ſtar-fiſh, a numerous tribe, ſhapeleſs and deformed, aſſuming at different times different appearances. The ſame animal that now appears round like a ball, ſhortly after flattens as thin as a plate. All of this kind are formed of a ſemi-tranſparent gelatinous ſubſtance, covered with a thin membrane, and, to an inattentive ſpectator, often appear like a lump of inanimate jelly, floating at random upon the ſurface of the ſea, or thrown by chance on ſhore at the departure of the tide. But upon a more minute inſpection, they will be found poſſeſſed of life and motion; they will be found to ſhot forth their arms in every direction, in order to ſeize upon ſuch inſects as are near, and to devour them with great rapacity. Worms, the ſpawn of fiſh, and even muſcles themſelves, with their hard reſiſting ſhell, have been found in the ſtomachs of theſe voracious animals; and what is very extraordinary, though the ſubſtance of their own bodies be almoſt as ſoft as water, yet they are no way injured by ſwallowing

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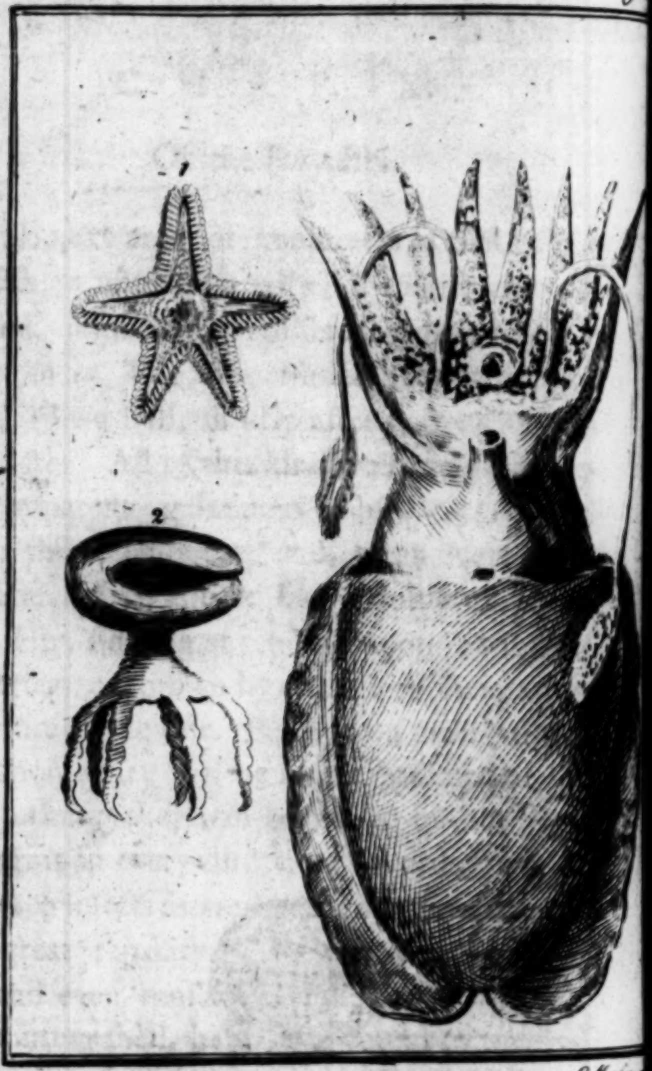


E. Marin

The Cuttle Fiſh.
1 The Sea Star.
2 The Sea Nettle.

theſe ſhells, which are almoſt of a ſtony hardneſs. They increaſe in ſize as all other animals do. In ſummer, when the water of the ſea is warmed by the heat of the ſun, they float upon the ſurface, and in the dark they ſend forth a kind of ſhining light reſembling that of phoſphorus. Some have given theſe animals the name of ſea-nettles, becauſe they burn the hands of thoſe that touch them, as nettles are found to do. They are often ſeen faſtened to the rocks, and to the largeſt ſea-ſhells, as if to derive their nouriſhment from them. If they be taken and put into ſpirit of wine, they will continue for many years entire, but if they be left to the influence of the air, they are, in leſs than four and twenty hours melted down into limpid and offenſive water.

In all of this ſpecies, none are found to poſſeſs a vent for their excrements, but the ſame paſſage by which they devour their food, ſerves for the ejection of their fæces. Theſe animals as was ſaid, take ſuch a variety of figures, that it is impoſſible to deſcribe them under one determinate ſhape; but in general, their bodies reſemble a truncated cone, whoſe baſe is applied to the rock to which they are found uſually attached. Though generally tranſparent, yet they are found of different colours, ſome inclining to green, ſome to red, ſome to white, and ſome to brown. In ſome, their colours appear diffuſed over the whole ſurface, in ſome, they are often ſtreaked, and in others often ſpotted. They are poſſeſt of a very ſlow progreſſive motion, and in fine weather, they are continually ſeen, ſtretching out and fiſhing for their prey. Many of them are poſſeſt of a number of long ſlender filaments, in which they entangle any ſmall animals they happen to approach, and thus draw them into their enormous ſtomachs, which fill the whole cavity of their bodies. The harder ſhells continue for ſome weeks indigeſted, but at length, they undergo a kind of maceration in the ſtomach, and become a part of the ſubſtance of the animal itſelf. The indigeſtible parts, are returned by the ſame aperture by which they were ſwallowed, and than the ſtar-fiſh begins to fiſh for more. Theſe alſo may be cut in pieces, and every part will ſurvive the operation; each becoming a perfect animal, endued with its natural rapacity. Of this tribe, the number is various, and the deſcription of each would be tedious and uninſtructing; the manners and nature of all, are nearly as deſcribed; but I will juſt make mention of one creature, which, tho' not properly belonging to this claſs, yet

yet is ſo nearly related, that the paſſing it in ſilence would be an unpardonable omiſſion.

Of all other animals, the cuttle-fiſh, though in ſome reſpects ſuperior to this tribe, poſſeſſes qualities the moſt extraordinary. It is about two feet long, covered with a very thin ſkin, and its fleſh compoſed of a gelatinous ſubſtance, which however within ſide is ſtrengthened by a ſtrong bone, of which ſuch great uſe is made by the goldſmith. It is poſſeſſed of eight arms, which it extends, and which are probably of ſervice to it in fiſhing for its prey; while in life, it is capable of lengthening or contracting theſe at pleaſure; but when dead, they contract and loſe their rigidity. They feed upon ſmall fiſh, which they ſeize with their arms; and they are bred from eggs, which are laid upon the weeds along the ſea-ſhore.

The cuttle-fiſh is found along many of the coaſts of Europe, but are not eaſily caught, from a contrivance with which they are furniſhed by nature; this is a black ſuſiſtance, of the colour of ink, which is contained in a bladder generally on the left-ſide of the belly, and which is ejected in the manner of an excrement from the anus. Whenever therefore this fiſh is purſued, and when it finds a difficulty of eſcaping, it ſpurts forth a great quantity of this black liquor, by which the waters are totally darkened; and then it eſcapes, by lying cloſe at the bottom. In this manner the creature finds its ſafety, and men find ample cauſe for admiration, from the great variety of ſtratagems with which creatures are endued for their peculiar preſervation.

CHAP. XI.

Of the Polypus.

THOSE animals which we have deſcribed in the laſt chapter, are variouſly denominated. They have been called the Star-fiſh, Sea-nettles, and Sea-polypi. This laſt name has been peculiarly aſcribed to them by the ancients, becauſe of the number of feelers or feet of which they are all poſſeſt, and with which they have a ſlow progreſſive motion; but the moderns have given the name of Polypus to a reptile that lives in freſh water, by no means ſo large or obſervable. Theſe are found at the bottom of wet ditches, or attached to the under ſurface of the broad-leafed plants that grow and ſwim on the waters. The ſame difference holds between theſe and the ſea-water polypus, as between all the productions of the ſea, and of the land and the ocean. The marine vegetables and animals grow to a monſtrous ſize. The eel, the pike, or the bream of freſh-waters, is but ſmall; but in the ſea, they grow to an enormous magnitude. The herbs of the field are at moſt but a few feet high; thoſe of the ſea often ſhoot forth a ſtalk of a hundred. It is ſo between the polypi of both elements. Thoſe of the ſea are found from two feet in length to three or four, and Pliny has even deſcribed one, the arms of which were no leſs than thirty feet long. Thoſe in freſh waters, however, are comparatively minute; at their utmoſt ſize, ſeldom above three parts of an inch long, and when gathered up into their uſual form, not above a third even of thoſe dimenſions.

It was upon theſe minute animals, that the power of diſſection was firſt tried in multiplying their numbers. They had been long conſidered as little worthy the attention of obſervers, and were conſigned to that neglect in which thouſands of minute ſpecies of inſects remain to this very day. It is true, indeed, that Reaumur obſerved, claſſed, and named them. By contemplating their motions, he was enabled diſtinctly to pronounce on their being of the animal, and not of the vegetable kingdom; and he called them Polypi, from their great reſemblance to thoſe larger ones that were found in the ocean. Still, however, their properties were neglected, and their hiſtory unknown.

Mr. Trembley was the perſon to whom we owe the firſt diſcovery of the amazing properties and powers of this little vivacious creature: he divided this claſs of animals into four different kinds; into thoſe inclining to green, thoſe of a browniſh caſt, thoſe of fleſh colour, thoſe which he calls the polype de panache. The differences of ſtructure in theſe, as alſo of colour, are obſervable enough; but the manner of their ſubſiſting, of ſeizing their prey, and of their propagation, is pretty nearly the ſame in all.

Whoever has looked with care into the bottom of a wet ditch, when the water is ſtagnant, and the ſun has been powerful, may remember to have ſeen many little tranſparent lumps of jelly, about the ſize of a pea, and flatted on one ſide; ſuch alſo as have examined the under ſide of the broad-leafed weeds that grow on the ſurface of the water, muſt have obſerved them ſtudded with a number of theſe little jelly-like ſubſtances, which were probably then diſregarded, becauſe their nature and hiſtory was unknown. Theſe little ſubſtances however, were no other than living polypi gathered up into a quieſcent ſtate and ſeemingly inanimate, becauſe either undiſturbed, or not excited by the calls of appetite to action. When they are ſeen exerting themſelves they put on a very different appearance from that when at reſt; to conceive a juſt idea of their figure, we may ſuppoſe the finger of a glove cut off at the bottom; we may ſuppoſe alſo ſeveral threads or horns planted round the edge like a fringe. The hollow of this finger will give us an idea of the ſtomach of the animal, the threads iſſuing forth from the edges may be conſidered as the arms or feelers, with which it hunts for its prey. The animal, at its greateſt extent, is ſeldom ſeen above an inch and a half long, but it is much ſhorter when it is contracted and at reſt; it is furniſhed neither with muſcles nor rings, and its manner of lengthening or contracting itſelf more reſembles that of the ſnail, than worms, or any other inſect. The polypus contracts itſelf more or leſs, in proportion as it is touched, or as the water is agitated in which they are ſeen. Warmth animates them, and cold benumbs them; but it requires a degree of cold approaching congelation before they are reduced to perfect inactivity; thoſe of an inch have generally their arms double, often thrice as long as their bodies. The arms, where the animal is not diſturbed, and the ſeaſon not unfavourable, are thrown about in various directions, in order to ſeize and entangle its little prey; ſometimes three or four of the arms are thus employed, while the reſt are contracted like the horns of a ſnail, within the animal's body. It ſeems capable of giving what length it pleaſes to theſe arms; it contracts and extends them at pleaſure, and ſtretches them only in proportion to the remoteneſs of the object it would ſeize.

These animals have a progreſſive motion, which is performed by that power they have of lengthening and contracting themſelves at pleaſure; they go from one part of the bottom to another; they mount along the margin of the water, and climb up the ſide of aquatic plants. They often are ſeen to come to the ſurface of the water, where they ſuſpend themſelves by their lower end. As they advance but very ſlowly, they employ a great deal of time in every action, and bind themſelves very ſtrongly to whatever body they chance to move upon as they proceed; their adheſion is voluntary, and is probably performed in the manner of a cupping glaſs applied to the body.

All animals of this kind have a remarkable attachment to turn towards the light, and this naturally might induce an enquirer to look for their eyes; but however carefully this ſearch has been purſued, and however excellent the microſcope with which every part was examined, yet nothing of the appearance of this organ was found over the whole body; and it is moſt probable that, like ſeveral other inſects which hunt their prey by their feeling, theſe creatures are unfurniſhed with advantages which would be totally uſeleſs for their ſupport.

In the center of the arms, as was ſaid before, the mouth is placed, which the animal can open and ſhut at pleaſure, and this ſerves at once as a paſſage for food, and an opening for it after digeſtion. The inward part of the animal's body ſeems to be one great ſtomach, which is open at both ends; but the purpoſes which the opening at the bottom ſerves are hitherto unknown, but certainly not for excluding their excrements, for thoſe are ejected at the aperture by which they are taken in. If the ſurface of the body of this little creature be examined with a microſcope, it will be found ſtudded with a number of warts, as alſo the arms, eſpecially when they are contracted; and theſe tubercles, as we ſhall preſently ſee, anſwer a very important purpoſe.

If we examine their way of living, we ſhall find theſe inſects chiefly ſubſiſting upon others, much leſs than themſelves; particularly a kind of millepedes that live in the water, and a very ſmall red worm, which they ſeize with great avidity. In ſhort, no inſect whatſoever, leſs than themſelves, ſeems to come amiſs to them: their arms, as was obſerved above, ſerve them as a net would a fiſherman, or perhaps more exactly ſpeaking, as a lime-twig does a fowler. Wherever their prey is perceived, which the animal effects by its feeling, it is ſufficient to touch the object it would ſeize upon, and it is faſtened without a power of eſcaping. The inſtant one of this inſect's long arms is laid upon a millepede, the little inſect ſticks without a poſſibility of retreating. The greater the diſtance at which it is touched, the greater is the caſe with which the Polypus brings the prey to its mouth. If the little object be near, tho' irretrievably caught, it is not without great difficulty that it can be brought to the mouth and ſwallowed. When the Polypus is unſupplied with prey, it teſtifies its hunger by opening its mouth; the aperture, however, is ſo ſmall that it cannot be eaſily perceived; but when, with any of its long arms, it has ſeized upon its prey, it then opens the mouth diſtinctly enough, and this opening is always in proportion to the ſize of the animal which it would ſwallow; the lips dilate inſenſibly by ſmall degrees, and adjuſt themſelves preciſely to the figure of their prey. Mr. Trembley, who took a pleaſure in feeding this uſeleſs brood, found that they could devour aliments of every kind, fiſh and fleſh as well as inſects; but he owns they did not thrive ſo well upon beef and veal, as upon the little worms of their own providing. When he gave one of theſe famiſhed reptiles any ſubſtance which was improper to ſerve for aliment, at firſt it ſeized the prey with avidity, but after keeping it ſome time entangled near the mouth, it let drop again with diſtinguiſhing nicety.

When ſeveral polypi happen to fall upon the ſame worm, they diſpute their common prey with each other. Two of them are often ſeen ſeizing the ſame worm at different ends, and dragging it at oppoſite directions with great force. It often happens that while one is ſwallowing its reſpective end, the other is alſo employed in the ſame manner, and thus they continue ſwallowing each his part, until their mouths meet together; they then reſt, each for ſome time in this ſituation, till the worm breaks between them, and each goes off with his ſhare; but it often happens, that a ſeemingly more dangerous combat enſues, when the mouths of both are thus joined upon one common prey together: the largeſt polypus then gapes and ſwallows his antagoniſt; but what is very wonderful, the animal thus ſwallowed ſeems to be rather a gainer by the misfortune. After it has lain in the conqueror's body for about an hour, it iſſues unhurt, and often in poſſeſſion of the prey which had been the original cauſe of contention; how happy would it be for men, if they had as little to fear from each other!

Theſe reptiles continue eating the whole year, except when the cold approaches to congelation; and then, like moſt others of the inſect tribe, they feel the general torpor of nature, and all their faculties are for two or three months ſuſpended; but if they abſtain at one time, they are equally voracious at another, and like ſnakes, ants, and other animals that are torpid in winter, the meal of one day ſuffices them for ſeveral months together. In general, however, they devour more largely in proportion to their ſize, and their growth is quick exactly as they are fed; ſuch as are beſt ſupplied, ſooneſt acquire their largeſt ſize, but they diminiſh alſo in their growth with the ſame facility, if their food be taken away.

Such are the more obvious properties of theſe little animals, but the moſt wonderful ſtill remain behind: Their manner of propagation, or rather multiplication, has for ſome years been the aſtoniſhment of all the learned of Europe. They are produced in as great a variety of manners as every ſpecies of vegetable. Some polypi are propagated from eggs, as plants are from their ſeed;

ſome are produced by buds iſſuing from their bodies, as plants are produced by inoculation, while all may be multiplied by cuttings, and this to a degree of minuteneſs that exceeds even philoſophical perſeverance.

With reſpect to ſuch of this kind as are hatched from the egg, little curious can be added, as it is a method of propagation ſo common to all the tribes of inſect nature; but with regard to ſuch as are produced like buds from their parent ſtem, or like cuttings from an original root, their hiſtory requires a more detailed explanation. If a polypus be carefully obſerved in ſummer, when theſe animals are chiefly active, and more particularly prepared for propagation, it will be found to burgeon forth from different parts of its body ſeveral tubercles or little knobs, which grow larger and larger every day; after two or three days inſpection, what at firſt appeared but a ſmall excreſcence takes the figure of a ſmall animal, entirely reſembling its parent, furniſhed with feelers, a mouth, and all the apparatus for ſeizing and digeſting its prey. This little creature every day becomes larger, like the parent, to which it continues attached; it ſpreads its arms to ſeize upon whatever inſect is proper for aliment, and devours it for its own particular benefit; thus it is poſſeſſed of two ſources of nouriſhment, that which it receives from the parent by the tail, and that which it receives from its own induſtry by the mouth. The food which theſe animals receive often tinctures the whole body, and upon this occaſion the parent is often ſeen communicating a part of its own fluids to that of its progeny that grows upon it; while, on the contrary, it never receives any tincture from any ſubſtance that is caught and ſwallowed by its young. If the parent ſwallows a red worm, which gives a tincture to all its fluids, the young one partakes of the parental colour; but if the latter ſhould ſeize upon the ſame prey, the parent polypus is no way benefited by the capture, but all the advantage remains with the young one.

But we are not to ſuppoſe that the parent is capable of producing only one at a time, ſeveral young ones are thus ſeen at once, of different ſizes, growing from its body, ſome juſt budding forth, others acquiring their perfect form, and others come to ſufficient maturity, and juſt ready to drop from the original ſtem to which they had been attached for ſeveral days. But what is more extraordinary ſtill, thoſe young ones themſelves that continue attached to their parent, are ſeen to burgeon, and propagate their own young ones alſo, each holding the ſame dependence upon its reſpective parents, and poſſeſſed of the ſame advantages that have been already deſcribed in the firſt connection. Thus we ſee a ſurpriſing chain of exiſtence continued, and numbers of animals naturally produced without any union of the ſexes, or other previous diſpoſition of nature.

This ſeems to be the moſt natural way by which theſe inſects are multiplied; their production from the egg being not ſo common; and though ſome of this kind are found with a little bladder attached to their bodies, which is ſuppoſed to be filled with eggs, which afterwards come to maturity, yet the artificial method of propagating theſe animals, is much more expeditious and equally certain: it is indifferent whether one of them be cut into ten, or ten hundred parts, each becomes as perfect an animal as that which was originally divided; but it muſt be obſerved, that the ſmaller the part which is thus ſeparated from the reſt, the longer it will be in coming to maturity, or in aſſuming its perfect form. It would be endleſs to recount the many experiments that have been tried upon this philoſophical prodigy;

the animal has been twiſted, and turned into all manner of ſhapes; it has been turned inſide out, it has been cut in every diviſion, yet ſtill it continued to move; its parts adapted themſelves again to each other, and in a ſhort time it became as voracious and induſtrious as before.

Beſides theſe kinds mentioned by Mr. Trembley, there are various others which have been lately diſcovered by the vigilance of ſucceeding obſervers, and ſome of theſe ſo ſtrongly reſemble a flowering vegetable in their forms, that they have been miſtaken by many naturaliſts for ſuch. Mr. Hughes, the author of the Natural Hiſtory of Barbadoes, has deſcribed a ſpecies of this animal, but has miſtaken its nature, and called it a ſenſitive flowering plant; he obſerved it to take refuge in the holes of rocks, and when undiſturbed, to ſpread forth a number of ramifications, each terminated by a flowery petal which ſhrunk at the approach of the hand, and withdrew into the hole from whence before it had been ſeen to iſſue. This plant however was no other than an animal of the polypus kind, which is not only to be found in Barbadoes, but alſo on many parts of the coaſt of Cornwall, and along the ſhores of the Continent.

CHAP. XII.

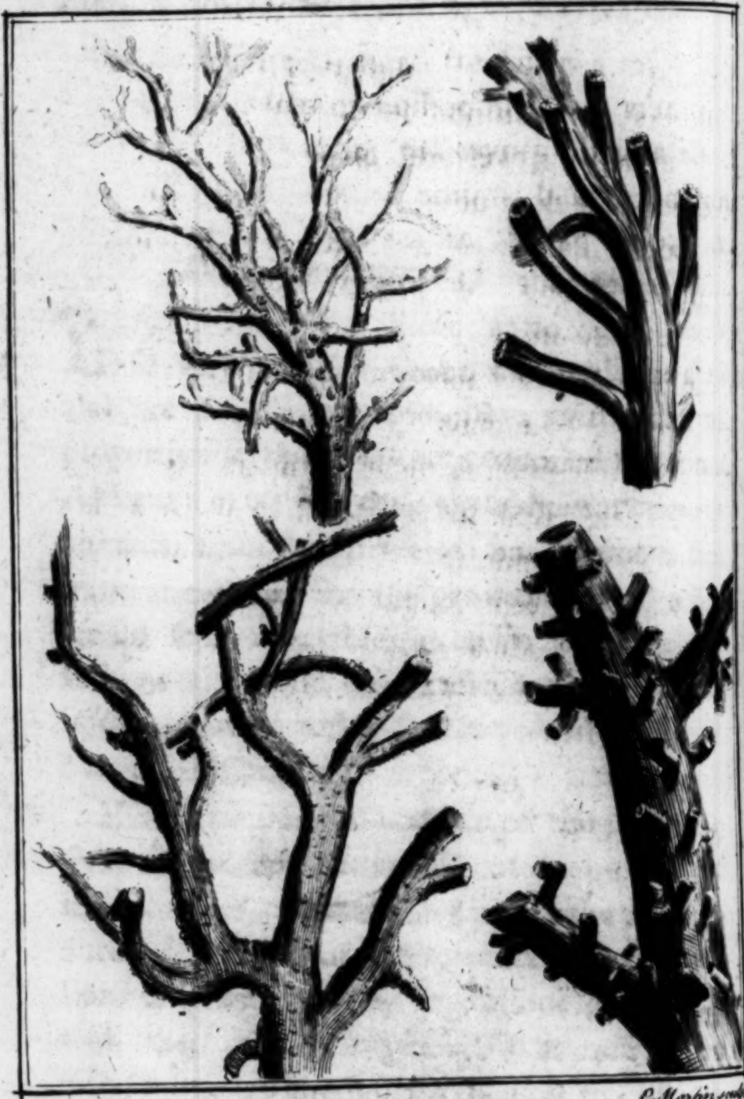
Of Lithophytes and Sponges.

IT is very probable that the animals we ſee, and are acquainted with, bear no manner of proportion to thoſe that are concealed from us. Although every leaf and vegetable ſwarms with animals upon land, yet at ſea, they are ſtill more abundant; for the greateſt part of what would ſeem vegetables growing there are in fact nothing but the artificial formation of inſects, palaces which they have built for their own habitation.

If we examine the bottom of the ſea along ſome ſhores, and particularly at the mouths of ſeveral rivers, we ſhall find it has the appearance of a foreſt of trees under water, millions of plants growing in various directions, with their branches entangled in each other, and ſometimes ſtanding ſo thick as to obſtruct navigation. The ſhores of the Perſian gulph, the whole extent of the Red-ſea, and the weſtern coaſts of America, are ſo choaked up in many places with theſe coraline ſubſtances, that tho' ſhips

9 OCT 48

Vol. 8. *Page. 193.*



C. Martin sculp.

The Coral-plants.

ſhips force a paſſage through them, boats and ſwimmers find it impoſſible to make their way. Theſe aquatic groves are formed of different ſubſtances, and aſſume various appearances. The coral plants, as they are called, ſometimes ſhoot out like trees without leaves in winter; they often ſpread out a broad ſurface like a fan, and not uncommonly a large bundling head, like a faggot; ſometimes they are found to reſemble a plant with leaves and flowers; and often the antlers of a ſtag, with great exactneſs and regularity. In other parts of the ſea are ſeen ſponges of various magnitude, and extraordinary appearances, aſſuming a variety of phantaſtic forms like large muſhrooms, mitres, fonts and flower-pots. To an attentive ſpectator theſe various productions ſeem entirely of the vegetable kind; they ſeem to have their leaves and their flowers, and have been experimentally known to ſhoot out branches in the compaſs of a year. Philoſophers, therefore, till of late, thought themſelves pretty ſecure in aſcribing theſe productions to the vegetable kingdom; and Count Marſigli, who has written very laboriouſly and learnedly upon the ſubject of corals and ſponges, has not heſitated to declare his opinion, that

that they were plants of the aquatic kind, furniſhed with flowers and ſeed, and endued with a vegetation entirely reſembling that which is found upon land. This opinion, however, ſome time after, began to be ſhaken by Rumphius and Juſſieu, and at laſt by the ingenious Mr. Ellis who by a more ſagacious and diligent enquiry into nature, put it paſt doubt, that corals and ſponges were entirely the work of animals and that like the honey-comb, which was formed by the bee, the coral was the work of an infinite number of reptiles of the polypus kind, whoſe united labours were thus capable of filling whole tracts of the ocean with thoſe embarraſſing tokens of their induſtry.

If in our reſearches after the nature of theſe plants, we ſhould be induced to break off a branch of the coraline ſubſtance, and obſerve it carefully, we ſhall perceive its whole ſurface, which is very rugged and irregular, covered with a mucous fluid, and almoſt in every part ſtudded with little jelly-like drops, which when cloſely examined, will be found to be no other than reptiles of the polypus kind. Theſe have their motions, their arms, their appetites exactly reſembling thoſe deſcribed in the laſt chapter, but they ſoon expire when taken out of the ſea, and our curioſity is at once ſtopped in its career, by the animals ceaſing to give any make of their induſtry; recourſe therefore has been had to other expedients, in order to determine the nature of the inhabitant, as well as the habitation.

If a coraline plant be ſtrictly obſerved, while ſtill growing in the ſea, and the animals upon its ſurface be not diſturbed, either by the agitation of the waters, or the touch of the obſerver, the little polypi will then be ſeen in infinite numbers, each iſſuing from its cell, and in ſome kinds, the head covered with a little ſhell, reſembling an umbrella, the arms ſpread abroad, in order to ſeize it prey, while the hinder part ſtill remains attached to its habitation, from whence it never wholly removes. By this time it is perceived that the number of inhabitants is infinitely greater that was at firſt ſuſpected; that they are all aſſiduouſly employed in the ſame purſuits, and that they iſſue from their reſpective cells, and retire into them at pleaſure. Still, however, there are no proofs that thoſe large branches which they inhabit are entirely the conſtruction of ſuch feeble and minute animals. But chemiſtry will be found to lend a clue to extricate us from our doubts in this particular. Like the ſhells which are formed by ſnails, muſcles and oyſters, theſe coraline ſubſtances effervеſce with acids, and may therefore well be ſuppoſed to partake of the ſame animal nature. But Mr. Ellis went ſtill farther, and examined their operations, juſt as they were beginning. Obſerving an oyſter-bed which had been for ſome time neglected, he there perceived the firſt rudiments of a coraline plantation, and tufts of various kinds ſhooting from different parts of this favourable ſoil. It was upon theſe he tried his principal experiment. He took out the oyſters which were thus furniſhed with coralines, and placed them in a large wooden veſſel, covering them with ſea-water. In about an hour, he perceived the animals, which before had been contracted by handling, and had ſhewn no ſigns of life, expanding themſelves in every direction, and appearing employed in their own natural manner. Perceiving them therefore in this ſtate, his next aim was to preſerve them thus expanded, ſo as to be permanent objects of curioſity. For this purpoſe he poured, by ſlow degrees, an equal quantity of boiling-water into the veſſel of ſea water in which they were immerſed. He then ſeparated each polypus with pincers from its ſhell, and plunged each ſeparately into ſmall cryſtal vaſes, filled with ſpirit of wine mixed with water. By this means, the animal was preſerved entire, without having time to contract itſelf, and he thus perceived a variety of kinds, almoſt equal to that variety of productions which theſe little animals are ſeen to form. He has been thus able to perceive and deſcribe fifty different kinds, each of which is ſeen to poſſeſs its own peculiar mode, of conſtruction, and to form a coraline that none of the reſt can imitate. It is true indeed, that on every coraline ſubſtance there are a number of polypi found, no way reſembling thoſe which are the erectors of the building; theſe may be called a vagabond race of reptiles, that are only intruders upon the labours of others, and that take poſſeſſion of habitations, which they have neither art nor power to build for themſelves. But in general, the ſame difference that ſubſiſts between the honeycomb of the bee, and the paper-like cells of the waſp, ſubſiſts between the different habitations of the coral-making polypi.

With regard to the various forms of theſe ſubſtances, they have obtained different names from the nature of the animal that produced them, or the likeneſs they bear to ſome well-known object, ſuch as coralines, fungimadrepores, ſponges, aſtroites, and keratophytes. Though theſe differ extremely in their outward appearances, yet they all are formed in the ſame manner by reptiles of various kinds and nature. When examined chemically, they all diſcover the marks of animal formation; the corals, as was ſaid, diſſolve in acids, the ſponges burn with an odour ſtrongly reſembling that of burnt horn. We are left ſomewhat at a loſs with regard to the preciſe manner in which this multitude of cells, which at laſt aſſume the appearance of a plant or flower, are formed. If we may be led in this ſubject by analogy, it is moſt probable, that the ſubſtance of coral is produced in the ſame manner that the ſhell of the ſnail grows round it; theſe little reptiles are each poſſeſſed of a ſlimy matter, which covers its body, and this hardening, as in the ſnail, becomes an habitation exactly fitted to the body of the animal that is to reſide in it; ſeveral of theſe habitations being joined together, form at length a conſiderable maſs, and as moſt animals are productive, in proportion to their minuteneſs, ſo theſe multiplying in a ſurpriſing degree, at length form thoſe extenſive foreſts that cover the bottom of the deep.

Thus all nature ſeems replete with life; almoſt every plant on land has its ſurface covered with millions of theſe minute creatures, of whoſe exiſtence we are certain, but of whoſe uſes we are entirely ignorant; while numbers of what ſeem plants at ſea are not only the receptacles of inſects, but alſo entirely of inſect formation. This might have led ſome late philoſophers into an opinion, that all nature was animated, that every, even the moſt inert maſs of matter, was endued with life and ſenſation, but wanted organs to make thoſe ſenſations perceptible to the obſerver: thoſe opinions, taken up at random, are difficultly maintained, and, as difficultly refuted; like combatants that meet in the dark, each party may deal a thouſand blows without ever reaching the adverſary. Thoſe perhaps are wiſer who view nature as ſhe offers; who without ſearching too deeply into the receſſes in which ſhe ultimately hides, are contented to take her as ſhe preſents herſelf, and ſtoring their minds with effects, rather than with cauſes, inſtead of the embarraſſment of ſyſtems, about which few agree, are contented with the hiſtory of appearances, concerning which, all mankind have but one opinion.

9 OCT 48

INDEX

INDEX

OF THE

Various Matter contained in this Work.

The Roman character denotes the volume, the Arabic number the page.

A.

ABDOMINAL Fiſh, has the ventral nearer the tail than the pectoral fins, vi. 304

Abſtemious life, its great benefit, ii. 200

Abſtinence, religiouſly obſerved long after the Reformation—queen Elizabeth's injunctions upon this head—a heavenly inſtitution, from its benefit to individuals, and advantage to ſociety, ii. 131—remarkable inſtance of it in the ſloth, iv. 347

Acanthopterigii, a name of the prickly-finned fiſh, vi. 303

Achilles, a Roman tribune, called the ſecond of that name, and why, ii. 117

Acorn, its ſhell filled by an immovable animal, viii. 162—a ſhell-fiſh, vii. 64

Adriatic, its empire claimed by the republic of Venice, i. 232

Ælian, his account of the dreadful cavern, called the Gulf of Pluto, i. 61. See *Elephant*, iv. 261.

Ætna, volcano in Sicily—remarkable eruption in 1537, i. 89—account of it—the burning ſeen at Malta, 90—the quantity of matter diſcharged, ſuppoſed to exceed twenty times the original bulk of the mountain, 102—walls built of materials thrown up by it, 103

Aeolipile, an inſtrument to produce artificial wind—

its deſcription, and the manner of generating violent blaſts, i. 337

Africa, its ſandy ſtorms, i. 363—deſtroy villages and armies, 366. See *Animals*, ii. 317—has the largeſt and ſmalleſt of the cow kind, iii. 14—the ferret originally from Africa, iv. 22—the natives are greatly degenerated, 267. See *Savages*, iv. 231. See *Elephant*, iv. 267

Age, the mountains of Scotland, Wales, Auvergne, and Switzerland, furniſh more inſtances of old age, than the plains of Holland, Flanders, Germany, or Poland, ii. 202. See *Trees*. See *Fiſhes*, vi. 176

Agouti, an animal found in great abundance in South America, and by ſome called the rabbit of that continent; it reſembles the rabbit, yet is different from ours, and peculiar to the new world, — its deſcription —its ordinary food—it has the hair and voraciouſneſs of a hog—eats greedily, and hides the remainder—burrows in hollow trees—its manner of feeding and walking—ſight and hearing—its fleſh, how dreſſed—how hunted and forced out of its hole—it turns in its own defence upon the hunters—its bite, and cry—how tamed —bears two young at each litter; breeds at leaſt twice a year; carries its young about like a cat, and lodges them in a tree, where they ſoon become able to provide for themſelves, iv. 49 to 52

Agricola, has ſeen hats made of mole ſkins, moſt beautiful, iv. 98

Agriculture, the number of hands employed in the manufacture of ſilk, turned to agriculture, would encreaſe the quantity of corn to more than an equivalent for the diminution of national wealth in purchaſing wrought ſilk from other countries, vi. 284

Ai, a name of the ſloth—its deſcription, iv. 344

Aicurous, a great parrot—its ſagacity and docility, v. 277

Aigues-mortes, town in France, a port in the time of St. Louis; now removed more than four miles from the ſea, i. 277

Air, the only active agent in earthquakes, i. 105—Amonton's calculation of a moderate degree of heat ſufficient to give the air amazing powers of expanſion,

9 OCT 48

106—too fine for our ſight, is very obvious to our touch—its elaſticity—a cubic foot of air weighs more than an ounce, 299—a hand upon the mouth of a veſſel from which the air has been exhauſted, is violently ſucked inwards, and why—the mouth of ſuch veſſel inverted being immerſed, the water will riſe into the empty ſpace, and fill the glaſs—the manner in which this is done—water never aſcends higher than thirty-two feet—our ordinary load of air amounts nearly to forty thouſand pounds—four thouſand pounds weight of air carried at one time more than at another, and why—the air contained in a nut-ſhell, may be dilated into unknown dimenſions—the air contained in a houſe, may be compreſſed into a cavity equal to the eye of a needle—the encreaſing elaſticity of compreſſed air augmented by heat, would when expanded be ſufficient for the exploſion of a world, 300 to 304—one of the moſt compounded bodies in nature, 311—ſcarce any ſubſtance reſiſting its corroding qualities, 312—factitious air produced in great quantities from vegetable, animal, or mineral ſubſtances—proves a greater enemy to animals than a vacuum—a bird encloſed in artificial air, from raiſins, died in a quarter of a minute—a frog included in artificial air—a ſnail put into the receiver, with air of paſte, died in four minutes—to be wholeſome, ſhould not be of one kind, but a compound of ſeveral ſubſtances, 318 to 320—how air contributes to the ſupport of our lives—a diſpute upon it—gives life and body to flame—kindles fire into flame, moderates the rays of light, and diſſipates their violence—conveyance of ſound—all the pleaſure received from converſation, or from muſic, depends entirely upon the air—odours are diffuſed by the air—vegetables, or the bodies of animals left to putrefy, produce air in a very copious manner—it finds admiſſion into wine or other fermented liquors, and moſt eaſily into ſpirits of wine—mountains, minerals, vegetables, animals, and fires, contribute to encreaſe a current of air, 331 to 338—a tide of air produced by the ſun and moon, 354—a current of air, driven through a contracted ſpace, grows more violent and irreſiſtible, 355

Air-pump. See *Carp*, vi. 169. 172. See *Fiſhes*, vi. 170, &c.

INDEX.

Air-bladder, in fiſhes, deſcribed, vi. 171

Albatroſs, a bird of the gull kind—its deſcription by Edwards—is an inhabitant of the tropical climates, and other regions, as far as the ſtreights of Magellan in the South Seas—is the moſt fierce and formidable of the aquatic tribe—it chiefly purſues the flying-fiſh, forced from the ſea by the dolphins—Wicquefort's account of this bird—it ſeems to have a peculiar affection for the penguin, and a pleaſure in its ſociety—its neſt, vi. 60 to 64.

Albouras, a famous volcano near mount Taurus, i. 98

Alder, hares will not feed on the bark of it, iv. 7

Algazel, the ſeventh variety of gazelles with Mr. Buffon, iii. 74

Aldrovandus, places the bats among birds, iv. 134—he having ſpent a fortune, to enlighten mankind, and collected more truth and falſhood than any man, was reduced to want, to ſuffer ingratitude, and to die in an hoſpital, vi. 117

Alexander's ſoldiers agitated by curioſity and apprehenſion at the tides in the river Indus, i. 257

Alligator, or the *Cayman*, a kind of crocodile, vii. 119

Alps, dreadful chaſms found in them, i. 59—Pope's deſcription of a traveller ſtraining up the Alps, 143—the higheſt point of them not above ſixteen hundred toiſes above the ſurface of the ſea, 153

Amazons, the greateſt river in the world, has its ſource among the Andes, i. 142—its courſe from its origin in the lake of Lauricocha, to its diſcharge into the Weſtern Ocean, is more than twelve hundred leagues,—its diſcharge is through a channel of an hundred and fifty miles broad, after receiving above ſixty conſiderable rivers, 215 to 217

Ambergriſe, long conſidered as a ſubſtance found floating on the ſea, but ſince diſcovered to belong to the cachalot—the balls of ambergriſe found in all fiſhes of this kind, but chiefly in the oldeſt and ſtrongeſt, vi. 220, 221

Ambroſe, (St.) his credulity concerning the halcyon, vi. 144

America exceeds in the ſize of its reptiles, but is inferior in its quadrupeds, ii. 332—that part of the American continent which lies under the line, is cool and pleaſant, 233—cauſe of the tawny colour of the North American Indians—they paint their ſkins with red oker, and anoint them with the fat of bears, 236—the original cauſe of their flat heads, 239—American wood-duck deſcribed, vi. 130. See *Tapir*, ii. 332. See *Quadrupedes*, ii. 332. See *Dog*, iii. 32. See *Rats*, iv. 71. See *Rabbits*, (Syrian) iv. 24. See *Bat*, iv. 146. See *Savages*, iv. 231. See *Pacos*, iv. 317. See *Mock-Bird*, v. 324

Amia, or *Bonito*, deſcription of this fiſh, vi. 314

Ammodytes, or the *Lance*, a fiſh—its deſcription, vi. 311

Ammodytes, a kind of viper—it darts with amazing ſwiftneſs, vii. 180

Amonton. See *Air*, i. 106

Amour, a river of Eaſtern Tartary, i. 210—it receives about forty leſſer rivers, 217

Amphiſbœna, or the double-headed ſerpent, vii. 222

Anarchicas, the wolf-fiſh, its deſcription, vi. 311

Anatomiſts. See *Apes*, ii. 311. See *Lamprey*, vi. 271

Anchovy has no bladder, vi. 174

Andaluſia, gennets of that province the beſt, ii. 357

Andes, amazing chaſms or fiſſures in them—ſome of theſe are a mile wide, and others, running under-ground, reſemble a province, i. 60—the higheſt mountains of the world, 99—excellent deſcription of them by Ulloa, 147—the Andes are by meaſure three thouſand one hundred and thirty-ſix toiſes, or fathoms, above the ſurface of the ſea, 151, 153—at the top no difficulty of breathing perceived, 154—manner of mules going down the precipices, ii. 387

Anemometer, an inſtrument to meaſure the velocity of the wind—gives no certain information of the force of a ſtorm, i. 356

Angora. The goat of Angora, iii. 57—a number of animals about Angora, affording hair for trade—the camlet made of ſuch hair, 58—the cat of Angora, 212

Anhima, a bird of the crane kind, of Braſil, v. 389—deſcribed—the cock and the hen prowl together—when one dies, the other ſtays by it, and dies alſo, 390

Animals hold the firſt rank amidſt the infinitely different productions the earth offers—are endowed with powers of motion and defence, even thoſe fixed to one ſpot—organized beings provided with ſome defence for their own ſecurity—endued with life and vigour—ſome, by nature, violent—have their enmities and affectations—ultimately ſupported upon vegetables—thoſe in a dry ſunny climate ſtrong and vigorous—different vegetables appropriated to the different appetites, and why—of domeſtic kinds, carried from milder countries into northern climates, quickly degenerate and grow leſs—in the internal parts of South America and Africa grow to a prodigious ſize, and why—not ſo in the cold frozen regions of the North—the moſt perfect races have the leaſt ſimilitude to the vegetable productions on which they are ultimately fed—the meaner the animal, the more local—aſſume different habits as well as appearances, and why—ſome peculiar to every part of the vegetable ſyſtem—there are that live upon other animals—this wiſely ſo conſtituted—to diminiſh the number of animals, and encreaſe that of vegetables—the general ſcope of human induſtry—of the vaſt variety, very few ſerviceable to man—in a catalogue of more than twenty thouſand land animals, ſcarcely an hundred are any way uſeful to man—expediency of man's living upon animals as well as vegetables—little more known than that the greateſt number require the concurrence of a male and female to reproduce their kind—and theſe, diſtinctly and invariably, found to beget creatures of their own ſpecies, ii. 1 to 16—uſual diſtinction, with reſpect to their manner of generation, into oviparous and viviparous kinds, 22—the warmth of the ſun, or of a ſtove, efficacious in bringing the animal in the egg to perfection, 27—ſuch parts as the animal has double, or without which it can live, are the lateſt in production, 35—De Graaf has attended the progreſs and encreaſe of various animals in the womb, and minutely marked the changes they undergo, 36—that which, in proportion to its bulk, takes the longeſt time for production, the moſt complete when finiſhed—of all others, man the ſloweſt in coming into life—the moſt formidable are the leaſt fruitful—and why—thoſe which bring forth many engender before they have arrived at half their natural ſize—approach more to perfection, whoſe generation nearly reſembles that of man, 48 to 50—men and apes only have eye-laſhes upon the upper and lower lids—all others want them on the lower lid, 85—that which has moſt deſires appears capable of the greateſt variety of happineſs—thoſe of the foreſt remain without food ſeveral weeks—all endure the want of ſleep and hunger with leſs injury to health than man—nature contracts the ſtomachs of carnivorous animals of the foreſt to ſuit them to their precarious way of living—but the meaner tribes are ſtill more capable of ſuſtaining life without food, 123 to 125—ſome lower animals ſeem to ſpend the greateſt part of their lives in ſleep, 134—ſome affected by muſic—inſtances of it, 168—thoſe furniſhed with hands have more underſtanding than others, 185—in general, the large animals live longer than the little, 200—difference between animals in a ſtate of nature and domeſtic tameneſs, ſo conſiderable that M. Buffon makes it a principal diſtinction of claſſes, 310—their teeth fitted to the nature of their food—and their legs as well fitted to their reſpective wants or enjoyments—thoſe who chew the cud have four ſtomachs—ſeveral that with us have four ſtomachs, have but two in Africa—no carnivorous animal, except the dog, makes a voluntary attack but with ſuperiority—the ſtomach generally proportioned to the nature of the food, or the eaſe with which it is obtained—the ſize of the inteſtines proportioned to the nature of the food—few of the wild ſort ſeek their prey in the day-time—in proportion as each carnivorous animal wants ſtrength, it uſes all the aſſiſtance of patience, aſſiduity, and cunning—ſome animals carefully avoid their enemies by placing centinels to warn the approach of danger, and know how to puniſh ſuch as have neglected their poſt, or been unmindful of the common ſafety—the wild ſort ſubject to few alterations, and in the ſavage ſtate continue for ages the ſame, in ſize, ſhape, and colour—is otherwiſe when ſubdued and taken under the protection of man—the tame kind bears no reſemblance to its anceſtors in the woods, animals feeding only upon graſs, rendered carnivorous—two inſtances, ii. 315 to 327—Africa ever remarkable for the fierceneſs of its animals—the ſmalleſt multiply the faſteſt—the larger ſort bring few at a time—ſeldom generate till they be near their full growth—thoſe which bring many reproduce before they arrive at half their natural ſize—with all animals, the time of their pregnancy is proportioned to their ſize—in all kinds, the intermediate litters the moſt fruitful—the firſt and laſt generally produce the feweſt in number and worſt of kind—natural inſtinct to chooſe the proper times of copulation—whatever the natural diſpoſition of animals, they have all courage to defend their young—inſtances of it—milk in the carnivorous animals more ſparing than in others—choice of ſituation in bringing forth, remarkable in animals, 331 to 338—the aſs, in a ſtate of tameneſs, the moſt gentle and quiet of all animals, 381—of all animals covered with hair, the aſs the leaſt ſubject to vermin, 386—the zebra the moſt beautiful, but the wildeſt animal in nature, 390—perfectly know their enemies, and how to avoid them—inſtances of it, 395—beſt method of claſſing animals adopted by Ray, Klein, and Linnæus, 294 to 299—the author's method of claſſing them, 301 to 308—the carnivorous ſeek their food in gloomy ſolitude—they are ſharper than the ruminating kind, and why—ruminating animals moſt harmleſs, and moſt eaſily tamed—generally go in herds, for their mutual ſecurity—live entirely upon vegetables—the meaneſt of them unite in each other's defence—carnivorous animals have ſmall ſtomachs and ſhort inteſtines—ruminating animals naturally more indolent and leſs artful than the carnivorous kinds, and why—their bowels conſidered as an elaboratory, with proper veſſels in it—nature enlarges the capacity of their inteſtines to take in a greater ſupply—and furniſhes them with four ſtomachs—the names of theſe four ſtomachs—the inteſtines of carnivorous animals are thin and lean; but thoſe of the ruminating ſort ſtrong, fleſhy, and well covered with fat—of all others, man ſpends the leaſt time in eating—of all ruminant, the cow kind deſerve the firſt rank, iii. 1 to 8—naturaliſts give various names to the ſame, only differing in accidental circumſtances—of all, except man, the cow moſt extenſively propagated—greateſt variety among cows, none more humble and pliant of diſpoſition—the large kind of the torrid zone very fond of the water—ſome void their dung, when purſued; this ariſes rather from fear, than a deſire of defence—the number of the cow kind, by naturaliſts extended to eight or ten ſorts, reduced to two; one animal of the cow kind, no naturaliſt has hitherto deſcribed, it may be added as a third ſpecies—deſcription of it—all the ruminant internally much alike, iii. 24 to 36—thoſe that take refuge under the protection of man, in a few generations become indolent and helpleſs—the ſheep, in a domeſtic ſtate, the moſt defenceleſs and inoffenſive, 38—alſo the moſt ſtupid, 40--a great number and variety about Angora; the inhabitants drive trade with their hair, 58—the kinds actually not diſtinguiſhed by the horns, colour, poſition of the ears, or fineneſs of the hair, 60—the fat, urine, beak, and even dung of various animals efficacious in ſome diſorders, 69—of all in the world, the gazelle has the moſt beautiful eye, 72—ſcarce one animal, except the carnivorous, that does not produce concretions in the ſtomach, inteſtines, kidnies, bladder, or in the heart, 76—no naturaliſt informs us whether that which bears the muſk, be a ruminant, or of the hog kind, 91—by a general rule, every animal lives about ſeven or eight times the number of years it continues to grow, 103—of all natives of this climate, none have ſuch a beautiful eye as the ſtag, 105—no two more nearly allied than the ſtag and the fallow deer; yet form diſtinct families, and never engender together, 125—many that once flouriſhed in the world, may now be extinct, 136—of all the deer kind, the rein deer the moſt extraordinary, and moſt uſeful, 149—of all, when young, none more prettily playful than the kitten, 202—many in Syria and Perſia remarkable for long ſoft hair, 212—moſt terreſtrial are larger, fiercer, and ſtronger, in warm than in cold or temperate climates, 213—they only not afraid ſingly to make oppoſition to the lion, the elephant, the rhinoceros, the tiger, and the hippopotamos, 225—of all American, the tiger the moſt formidable and miſchievous, 245—the generality have greater agility, greater ſwiftneſs, and more formidable arms, from nature, than man; and their ſenſes, particularly that of ſmelling, are far more perfect, 275—thoſe living upon fleſh hunt by nature, 276—all under the influence of man, are ſubject to great variations, 279—many in this country

Breed between a dog and a fox, 298—all ſavage, that have once taſted human fleſh, never refrain from purſuing mankind, 336—thoſe of the north, in winter, are more hairy, than thoſe of the milder climates, and what the cauſe, 355—of the arctic climates, have their winter and ſummer garments, except as far north as Greenland, 356—of the weazel kind, the martin the moſt pleaſing, 368—feeding entirely upon vegetables, are inoffenſive and timorous, iv. 3—remarkable for ſpeed, except the horſe, have the hind feet longer than the fore, 4—none receives the male when pregnant, except the hare, 6—hares, they only that have hair on the inſide of their mouths, 8—few of the wild kind have ſo many varieties as the ſquirrel, 25—all are tamed more difficultly in proportion to their cowardice, 72—in all countries, civilized and improved, the lower ranks of animals repreſſed and degraded, 157—the beaver the only one that in its fore parts reſembles a quadruped, and in its hinder parts approaches the nature of fiſhes, 159—a true judgment of their diſpoſition by their looks, and a juſt conjecture of their internal habits from their external form, 208—the lori, of all other the longeſt, in proportion to ſize, 241—the camel the moſt temperate of all, 303—the oſtrich the moſt voracious, v. 54—of all that uſe their wings and legs in running, the oſtrich is the ſwifteſt, 60—none has greater courage than the cock, oppoſed to one of his own ſpecies, 163—the preſence of man deſtroys the ſociety of meaner animals, and their inſtincts alſo, vi. 64—thoſe longeſt in the womb, are the longeſt lived, according to Pliny, 119—none harder to be killed than the ſhark, 244—the ſnail kind are hermaphrodites, vii. 30—of all four-footed, the frog the beſt ſwimmer, 75—the caterpillar has the greateſt number of enemies, viii. 43—whatever kind, long under the protection of man, loſe part of their natural ſagacity, in providing for themſelves, 83—that which fills the acorn-ſhell is immoveable—a moſt numerous tribe lately diſcovered, propagated by cuttings—many entirely without motion—all ſeem poſſeſſed of one power, of which vegetables are totally deficient, 162—certain races of animals fall beneath vegetables, by their more imperfect propagation, 163—

ome live without limbs, and often reproduce them; ome live without brain for many weeks together; ſome ncreaſe and grow large, though all their nobler organs re entirely deſtroyed; ſome continue to exiſt, though ut in two; their nobler parts preſerving life, while the thers periſh that were cut away; the zoophyte tribe, ontinues to live in ſeparate parts, and one animal, by he means of cutting, is divided into two diſtinct exſtences, ſometimes into a thouſand, 170, 171—the firſt iſcovery of the power of reproduction in animals wing to Mr. Tremblay, 172

Antelope, tenth variety of gazelles by Mr. Buffon—its deſcription—the Indian antelope, iii. 78, 79

Antilles. See *Negroes*, ii. 180

Antlers, their diſtinct names, iii. 114

Antiparos, its grotto moſt remarkable, i. 67

Antipathy, many have it to ſome animals, whoſe preſence they inſtantly ſmell, ii. 182—no animals more alike than the cow and buffalo, yet none have ſtronger diſlikes to each other, iii. 26—dogs and wolves ſo different in their diſpoſitions, that no animals can have a more perfect antipathy, 309—the ſame ſubſiſts between the jackall and the dog, 338—of the marmout to the dog, iv. 39—quadrupedes which have natural antipathy againſt the Norway rat, iv. 69, 70—between the porcupine and ſerpent ſo irreconcileable, as never to meet without a mortal engagement, 111

Antiquity, moſt naturally looked up to with reverential wonder, ii. 263

Anthony, St. lived an hundred and five years, ii. 132

Ants, every writer of antiquity deſcribes this inſect, as labouring in the ſummer, and feaſting upon the produce during the winter; in ſome of the warmer climates this may be ſo; but in France and England they are in a ſtate of torpidity during winter—common ants of Europe—their deſcription—fears not to attack a creature ten times its own magnitude—are divided into males, females, and neutral or working tribe—in what manner diſtinguiſhed from each other—males and females ſeem no way to partake in the common drudgeries of the ſtate—males purſue the females with great aſſiduity, and force them to compliance—remain coupled for ſome time—deſcription of the ant-hills in ſouthern parts of Europe conſtructed with wonderful contrivance—their food and excurſions—their eggs ſo very ſmall, that, upon a black ground, they can ſcarcely be diſcerned—fond attachment of the working ants to their progeny—the aurelia ſtate, and efforts to get rid of their ſkins—experiment of Mr. de Geer to this purpoſe—ſtate of the female, after ſhe has done laying, not known; the males then fly away, and are heard of no more—ants of the tropical climates build a hill with great contrivance and regularity, lay up proviſions, and, living the whole year, ſubmit to regulations entirely different from the ants of Europe—three kinds of African ants—their hills from ſix to twelve feet high—amazing number and regularity of their cells—depredations and adventures—they live under ſtrict regulations—order in which they ſally forth—often quit their dwelling in a body, and go in queſt of adventures—an inſtance of it given by Smith—their ſting produces extreme pain, viii. 115 to 127—drive the hare from its form, iv. 12—many animals live upon ants in Africa and America, 338

Ant-lion, the, vii. 323

Ant-eater, or *Ant-bear*, deſcription and habits—their art to catch the ants—manner of defence againſt its enemies—kills the invader, and remains faſtened upon him with vindictive deſperation, iv. 339 to 342

Antioch, buried by an earthquake, i. 110

Aorta, the great artery, ii. 41

Aperea, by ſome the Braſilian rabbit, iv. 54—its deſcription, 55

Apes, have eye-laſhes upon the upper and lower lids, ii. 85—the only animal poſſeſſed of hands and arms, 105—in ſome of the kind the reſemblance to man ſo ſtriking, that anatomiſts are puzzled to find in what part of the human body man's ſuperiority conſiſts—enjoy many advantages in common with men, above the lower tribes of nature 311—the foremoſt of the kind is the ouran-outang or wild man of the woods—deſcription of this animal by Dr. Tyſon—comparative view of this creature with man—another deſcription of it by Mr. Buffon—two young ones, but a year old, diſcovered an aſtoniſhing power of imitation—kind called baris, properly inſtructed when young, ſerv as uſeful domeſtics—Le Comte's account of an ape in the ſtreights of Molucca—the long-armed ape an extraordinary and remarkable creature—its deſcription—a native of the Eaſt Indies, and found along the coaſts of Coromandel—fling themſelves from one rope to another, at thirty, forty, and fifty feet diſtance—inſtances of amazing nimbleneſs—in a ſtate of nature they run upon all fours—certain proofs of it—ſlight ſurvey of the ape kind, iv. 188 to 207—in the navies of Solomon, among the articles imported from the Eaſt, are apes and peacocks, v. 171

Apicius, noted for having taught mankind to ſuffocate fiſh in Carthaginian pickle, vi. 182—his receipt for making ſauce for the oſtrich, v. 59—his manner of dreſſing a hare in true Roman taſte, iv. 15

Apodal, the name of the fiſh without ventral fins, vi. 303

Appendices in the inteſtines of birds, v. 16

Appetite, nature, by ſupplying a variety, has multiplied life in her productions, v. 79

Arabia, its ſandy tempeſts deſcribed, i. 363—men and animals buried in the ſands of Arabia, preſerved from corruption, for ſeveral ages, as if actually embalmed, ii. 275—the aſs originally a native of Arabia, 385. See *Horſes*, ii. 345 to 355. See *Camel*, iv. 303, 304

Archimedes, diſcovered the method of determining the purity of gold, by weighing it in water, i. 190

Archipelago, very good horſes in its iſlands, ii. 360—the wild aſs found in thoſe iſlands, particularly Cerigo, ii. 377

Ardebil, the paſtures in thoſe plains excellent for rearing horſes, ii. 361

Arequipa, a celebrated burning mountain in Peru, i. 99

Argentine, deſcription of this fiſh, vi. 314

Arion, his harp gathered the dolphins to the ſhip's ſide, ii. 168

Ariſtotle's opinion about the formation of the incipient animal, ii. 16—and mules being ſometimes prolific, 375

Arlotto, an Italian Franciſcan friar—for his ſleeping tranſgreſſions taken before the inquiſition, and like to be condemned for them, ii. 142, 143

Armadilla, or *Tatou*, generally referred to the tribe of inſects or ſnails, ii. 313—an inhabitant of South America

—a harmleſs creature, furniſhed with a peculiar covering for its defence—attacked without danger, and liable to perſecutions—is of different ſizes; in all however the animal is partially covered with a coat of mail, a ſtriking curioſity in natural hiſtory—has the ſame method of protecting itſelf as the hedge-hog or pangolin—when attacked, rolls itſelf up in its ſhells, like a ball, and continues ſo till the danger is over—the Indians take it in this form, lay it cloſe to the fire, and oblige it to unfold—this animal utterly unknown before the diſcovery of America—does miſchief in gardens—bears the cold of our climate without inconvenience—the mole does not burrow ſwifter than the armadilla—burrows deep in the earth—expedients uſed to force them out—manner of taking them alive—ſometimes in ſnares by the ſides of rivers, and low moiſt places, which they frequent—never found at any diſtance from their retreats—near a precipice, eſcapes by rolling itſelf up, and tumbling down from rock to rock, without danger or inconvenience—its food—ſcarce any that do not root the ground like a hog—a kind of friendſhip between them and the rattle-ſnake, they are frequently found in the ſame hole—they all reſemble each other, as cloathed with a ſhell, yet differ in ſize, and in the diviſion of their ſhell—the various kinds—the pig-headed ſort, the weaſel-headed, the kabaſſou and the encoubert are the largeſt, iv. 125 to 133

Arno, the river, a conſiderable piece of ground gained at the mouth of it, i. 276

Aro, numbers of birds of paradiſe ſeen there, v. 260

Arſe-feet, name our ſailors give to birds of the penguin tribe, vi. 92

Arſenius, tutor to the emperor Arcadius, lived an hundred and twenty years, ii. 132

Arts, fault that has infected moſt of our dictionaries and compilations of natural hiſtory, ii. 307

Aſia, aim of the Aſiatics to poſſeſs many women, and to furniſh a ſeraglio their only ambition, ii. 72—luſtre of jewels and ſplendor of brilliant colours eagerly ſought after by all conditions of men, 98

Aſia Minor, deſcription of its inhabitants, ii. 230

Aſiatic, the olive-coloured, claims the hereditary reſemblance to our common parent—an argument to prove the contrary, ii. 240

Aſp, a kind of ſerpent, vii. 215

Aſphaltum, an injection of petroleum and an application of aſphaltum ſuffice to make a mummy, ii. 287

Aſs and horſe, though nearly alike in form, are diſtinct kinds, different in natures—with only one of each kind, both races would be extinguiſhed—in the ſtate of nature entirely different—wild aſs in greater abundance than the wild horſe—wild aſs and the zebra a different ſpecies—countries where the wild aſs is found—ſome run ſo ſwift, few courſers can overtake them—caught with traps—taken chiefly for their fleſh and ſkins, which make that leather called ſhagreen—entertainment of wild aſſes in Perſia ſeen by Olearius—the delicacy of its fleſh a proverb there—Galen deems it unwholeſome—aſſes originally imported into America by the Spaniards, have run wild, and multiplied to ſuch numbers as to be a nuiſance—chace of them in the kingdom of Quito—have all the ſwiftneſs of horſes—declivities and precipices do not retard their career—after the firſt load, their celerity leaves them, their dangerous ferocity loſt, and they contract the ſtupid look and dullneſs peculiar to the aſinine ſpecies—will not permit a horſe to live among them—always feed together—and a horſe ſtraying where they graze, they fall upon, and bite and kick him till he be dead—their preferenee of the plantane to any other vegetable—they drink as ſoberly as they eat, and never dip the noſe into the ſtream—fear to wet their feet, and turn out to avoid the dirty parts of a road—ſhew no ardour but for the female, and often die after covering—ſcent an owner at a diſtance, and diſtinguiſh him in a crowd—with eyes covered, they will not ſtir a ſtep—when laid down, one eye covered with the graſs, and the other hidden with a ſtone or other contiguous body, they will not ſtir, or attempt to riſe, to get free from impediments—ſeveral brought up to perform, and exhibited at a ſhow—ſuffered to dwindle every generation, and particularly in England—bulk for bulk, an aſs ſtronger than a horſe, and ſurer footed—alſo leſs apt to ſtart than the horſe—more healthy than the horſe—Perſians cleave their noſtrils to give more room for breathing—Spaniards alone know the value of the aſs—

the Spaniſh jack-aſs above fifteen hands high—the aſs originally a native of Arabia—warm climates produce the largeſt and beſt—entirely loſt among us during the reign of queen Elizabeth—Holingſhed pretends our land yields no aſſes, yet they were common in England before that time—in Sweden, they are a ſort of rarity—by the laſt hiſtory of Norway, they had not reached that country—in Guinea, they are larger and more beautiful than the horſes of that country—in Perſia, are two kinds—ſome ſold for forty or fifty pounds—no animal covered with hair leſs ſubject to vermin—lives till twenty or twenty-five—ſleeps leſs than the horſe, and never lies down, unleſs much tired—ſhe-aſs croſſes fire and water to protect her young—the gimerro bred between the aſs and the bull—the ſize and ſtrength of our aſſes improved by importation of Spaniſh jack-aſſes, ii. 375 to 387—deſtroyed by the South-American bat, called vampyre, iv. 145

Aſafœtida, ſavage nations delighted with the ſmell, ii. 181

Aſſiniboils, lake, where the river St. Lawrence takes its riſe, i. 216

Aſtroits, among coral ſubſtances, viii. 197

Atalantis, an iſland ſubmerſed, was as large as Aſia Minor and Syria—the fruits of the earth offered without cultivation, i. 134

Athanatus, inſtance of his ſtrength, ii. 118

Athelſtan, prohibited the exportation of mares and ſtallions, except as preſents, ii. 369

Athenians, had their cock-matches, v. 163. See *Quail-Fighting*, v. 214

Atherine, deſcription of this fiſh, vi. 313

Atmoſphere, moſt diſorders incident to mankind, ſays Bacon, ariſe from changes of the atmoſphere, vi. 175

Attraction defined, i. 3—the ſun poſſeſſed of the greateſt ſhare, i. 4

Avoſetta, or ſcooper, a bird found in Italy—now and then comes over into England—deſcription, and extraordinary ſhape of its bill, vi. 20

Aurelia, one of the appearances of the caterpillar, viii. 6, 19—laying it in a warm room, Mr. Reaumur haſtened the diſcloſure of the butterfly, and by keeping it in an ice-houſe, retarded it—though it bears a different appearance, it contains all the parts of the butterfly in perfect formation—ſome inſects continue under that form not above ten days, ſome twenty, ſome ſeveral months, others for a year together, 26—how the butterfly gets rid of that covering, 28—aurelia of the bee different from that of the common caterpillar, 80

Aurora Borealis, or northern light, ſtreams, with peculiar luſtre, and a variety of colours, round the pole—its appearance almoſt conſtant in winter—and when the ſun departs for half a year, this meteor ſupplies its beams, affording light for all the purpoſes of exiſtence, i. 387

Aurora, or the ſamiri, the ſmalleſt and moſt beautiful of the ſapajou monkies—its deſcription—is very tender, delicate, and held in high price, iv. 236

Auvergne, in France, an amazing mummy dug up at that place, ii. 283

Auk, a bird bred in the iſland of St. Kilda, vi. 98

Axis, a kind of beautiful ſtag—its deſcription, iii. 123

Azores, ſerpents, adders, and ſnakes ſeen about theſe iſlands by ſir Robert Hawkins in 1590, i. 239

B.

Baboon, ſurvey of the baboon kind, iv. 188—fierce, malicious, ignorant, and untractable—its deſcription—impelled by a hatred for the males of the human ſpecies, and a deſire for women—the chevalier Forbin relates, that in Siam, whole troops will ſally forth, plunder the houſes of proviſions, and endeavour to force the women—manner of robbing an orchard or vineyard at the Cape of Good Hope—the female brings forth one at a time, carries it in her arms, clinging to her breaſt—at the Cape of Good Hope, the young of theſe animals are taught to guard houſes, and perform the duty with punctuality—they ſeem inſenſible of the miſchief they do—a baboon deſcribed by Mr. Buffon—laſciviouſneſs predominant—their food—are not found to breed in our climate—are not carnivorous—their liver, like that of a dog, divided into ſix lobes—the largeſt of the kind is the mandril—its deſcription—diſpleaſed, it weeps like a child—is a native of the Gold Coaſt—that called wanderow chiefly ſeen in the woods of Ceylon and Malabar

—its deſcription—the maimon of Buffon, by Edwards called the pig-tail, the laſt of the ſort—its deſcription —a native of Sumatra, iv. 209 to 215

Baby, the name of a dwarf, whoſe complete hiſtory is very accurately related by Mr. Daubenton, ii. 254

Babyroueſſa, the Indian hog, its deſcription—travellers call it the hog of Borneo—in what manner it eſcapes the purſuers—has enormous tuſks of fine ivory—leſs dangerous than the wild boar—the tuſks have points directed to the eyes, and ſometimes grow into them—theſe animals, in a body, are ſeen with the wild boars, with which they are not known to engender—are eaſily tamed—have a way of repoſing different from other animals of the larger kind, by hitching one of their upper tuſks on the branch of a tree, and ſuffering their whole body to ſwing down at eaſe—they are fierce and terrible when offended, and peaceable and harmleſs when unmoleſted—their fleſh good to be eaten, but ſaid to putrefy in a ſhort time—they chiefly live upon vegetables and the leaves of trees—are found in the iſland of Borneo, and in other parts of Aſia and Africa, iii. 192 to 196

Bacon's obſervations upon fiſhes, vi. 175

Badger, a ſolitary ſtupid animal—forms a winding hole, and remains in ſafety at the bottom—the fox takes poſſeſſion of the hole quitted by the badger, or forces it from the retreat by wiles—ſurpriſed by the dogs at a diſtance from its hole, it fights with deſperate reſolution —all that has life is its food—it ſleeps the greateſt part of the time, and, though not voracious, keeps fat, particularly in winter—it keeps the hole very clear—the female makes a bed of hay for her young—brings forth, in ſummer, three or four young—how ſhe feeds them—the young are eaſily tamed—the old are ſavage and incorrigible—are fond of fire, and often burn themſelves dangerouſly—are ſubject to the mange, and have a gland under the tail, which ſcents ſtrongly—its fleſh rank and ill taſted, iv. 328 to 330

Bag, name of the falſe belly of the oppoſſum—its deſcription, iv. 243

Bag, or pouch of the civet. See *Civet*, iii. 390

Bait, the beſt for all kinds of fiſh is freſh herring, vi. 256—the larger ſort will take a living ſmall fiſh upon the hook ſooner than any other bait, 257

Balance, to determine the ſpecific gravity of metals, i. 190

Balearic crane, its deſcription—the real crane of Pliny—comes from the coaſt of Africa and Cape de Verd iſlands—its habits—has been deſcribed by the name of ſea-peacock—foreign birds of the crane kind deſcribed, the jabiru, the jabiru-guacu, the anhima, and the buffoon bird, v. 386 to 389

Ball of fire of the bigneſs of a bomb—its effects, i. 380

Baltic, the Danes in poſſeſſion of it, i. 232

Banks of a river, after inundations, appear above water, when all the adjacent valley is overflown, and why, i. 202, 203

Banana, the elephant eats this plant to the roots, iv. 259

Barb, an Arabian horſe bred in Barbary, ii. 355

Barbs of the whale, or whale-bone, vi. 196

Barbary hen, its deſcription, v. 193

Barble, a flat fiſh, its growth, vi. 340

Barja, in South America, cattle deſtroyed at that place by the American bats called vampyres, iv. 146

Baris. See *Apes*, iv. 198

Barnacle, imaginary, a ſhell-fiſh, vii. 64

Barometer, ſerviceable in meaſuring the heights of mountains, i. 154—meaſures the weight of the air—in what manner, 304—no changes in the air without ſenſible alteration in the barometer, 305, 306—when it marks a peculiar lightneſs in the air, no wonder that it foretells a ſtorm, and why, 352

Barretier, a famous youth, conſidered as a prodigy of learning at the age of fourteen, ſlept regularly twelve hours in the twenty-four, ii. 138

Baſs, a rocky iſland in the Firth of Forth. See *Birds*, vi. 72

Bath, perſons coming out of a warm bath ſeveral ounces heavier than they went in—warm bath of ſea-water a kind of relief to mariners, upon a failure of freſh water at ſea, i. 238

Bat, bats as big as rabbits, ii. 6—by ſome reckoned among birds, 313—doubtful among naturaliſts whether beaſt or bird—now univerſally take place among quadrupeds—Pliny, Geſner, and Aldrovandus placed it among birds—ſcarce in any particular reſembles the bird, except the power of ſuſtaining itſelf in the air—deſcription of the common ſort in England—its inteſtines and ſkeleton, in ſome meaſure, reſemble thoſe of mankind—makes its firſt appearance early in ſummer, and begins its flight in the evening—is ſeen to ſkim along the ſurface of waters—feeds upon gnats, moths, and nocturnal inſects of every kind, which it purſues open-mouthed—its flight laborious, irregular, and, if interrupted, not readily followed by a ſecond elevation—uſually taken, when ſtriking againſt an object it falls to the ground—even in the ſummer, it ſleeps the greateſt part of the time—its retreat—continues in a torpid ſtate during winter—is uſually hanging by its hooked claws to the roofs of caves, unaffected by all change of weather—is deſtroyed particularly by the owl—the bat couples and brings forth in ſummer from two to five young at a time—the female has two nipples forward on the breaſt, as in the human kind, and this a motive for Linnæus to give it the title of a primas, to rank it in the ſame order with mankind—the female makes no neſt for her young—when ſhe begins to grow hungry, and finds a neceſſity of ſtirring abroad, ſhe takes her little ones and ſticks them by their hooks againſt the ſides of her apartment, and there they immoveably cling and patiently wait her return—leſs ſimilitude to the race of birds than of quadrupedes—great labour in flying ſoon fatigues and tires it in leſs than an hour—its petty thefts upon the fat of bacon—long-eared bat—horſeſhoe bat—rhinoceros bat—a larger race of bats in the Eaſt and Weſt Indies truly formidable—a dangerous enemy—when united in flocks they become dreadful—they are eat—the negroes of the African coaſts will not eat them though ſtarving—on the African coaſt they fly in ſuch numbers, as to obſcure the ſetting ſun—the rouſette, or great bat of Madagaſcar, is found along the coaſts of Africa and Malabar, where it is often ſeen about the ſize of a large hen—deſtroys the ripe fruits, and ſometimes ſettles upon animals, and man himſelf—deſtroys fowls and domeſtic animals, unleſs preſerved with the utmoſt care, and often faſten upon the inhabitants, attack them in the face, and make terrible wounds—the ancients have taken their idea of harpies from theſe fierce and voracious creatures, equally deformed, greedy, uncleanly, and cruel—the bat, called the American vampyre—its deſcription by Ulloa—purport of his account confirmed by various travellers, who all agree that it has a faculty of drawing blood from perſons ſleeping, and deſtroying them before they awake—a ſtrong difficulty remains how they make the wound—Ulloa and Buffon's opinions—ſuppoſe the animal endowed with a ſtrong power of ſuction; and that, without inflicting any wound, by continuing to draw, it enlarges the pores of the ſkin, ſo that the blood at length paſſes—they are one of the great peſts of South America, iv. 134 to 146—found in the holes deſerted by the wood-pecker, v. 253

To Bay, ſaid of a ſtag, when he turns his head againſt the hounds, iii. 114

Beagle. See *Hound.* iii. 283

Beak, how that of animals is produced, ii. 101

Beam, by hunters meant that part which bears the antlers, iii. 114

Beams, thoſe of the ſun ſhining upon the fire, put it out, and why—darting directly upon us, without the medium of the air, would burn us up at once, or blind us with effulgence, i. 333, 334

Bears, in cold frozen regions of the North not ſmaller than in milder countries, ii. 6—the North American Indians anoint their ſkins with fat of bears, 236—the bears now and then make depredations upon the rein-deer, iii. 169—in Greenland do not change colour, 356—three different kinds—the black of America does not reject animal food, as believed—places where they are found—retreat of the brown bear—a vulgar error, that, during winter, the brown bear lives by ſucking its paws; it ſeems rather to ſubſiſt then upon the exuberance of its former fleſh—the male and ſemale do not inhabit the ſame den, and ſeldom are ſeen together, but upon the acceſſes of genial deſire—care of the female for her young—the bear, when tamed, ſeems gentle and placid; yet ſtill to be diſtruſted and managed with caution, being often treacherous and reſentful without a cauſe—is capable of a degree of inſtruction—when come to maturity, can never be tamed—methods of taking them—their paws and hams a great delicacy—the white placed in the coldeſt climates, grows larger than in the temperate zones, and remains maſter of the icy mountains in Spitzbergen and Greenland—unable to retreat when attacked with fire-arms, they make a fierce and long reſiſtance—they live upon fiſh and ſeals, their fleſh is too ſtrong for food—are often ſeen on ice-floats, ſeveral leagues at ſea, though bad ſwimmers—the white ſometimes jumps into a Greenlander's boat, and if it does not overſet it, ſits down calmly, and, like a paſſenger, ſuffers itſelf to be rowed along—hunger makes it ſwim after fiſh—often a battle enſues between a bear and a morſe, or a whale, and the latter generally prove victorious, iv. 321 to 327

Beards, Americans taking great pains to pluck theirs up by the roots, the under part, and all but the whiſkers, therefore ſuppoſed to have no hair growing on that part—Linnæus himſelf has fallen into this miſtake—different cuſtoms of men, in the manner of wearing their beards, ii. 95 to 97

Beaſts are moſt fierce and cruel in all countries where men are moſt barbarous, ii. 330

Beaſts of chace, in the reigns of William Rufus, and Henry the Firſt, it was leſs criminal to deſtroy one of the human ſpecies than a beaſt of chace—ſacred edifices thrown down, and turned to waſte, to make room for beaſts of chace, iii. 110

Beaſts of prey, ſeldom devour each other—they chiefly ſeek after the deer or the goat—their uſual method of hunting, ii. 321

Beaver, known to build like an architect, and rule like a citizen, ii. 328—its fore parts taſte like fleſh, and the hinder like the fiſh it feeds on, iii. 192—a remaining monument of brutal ſociety—its qualities, taken from its fellows, and kept in ſolitude or domeſtic tameneſs—reſiſts only when driven to extremity, and fights when its ſpeed cannot avail—the only quadrupede that has a flat broad tail, covered with ſcales, ſerving as a rudder to direct its motions in the water—the ſole quadrupede with membranes between the toes on the hind feet, and none on the fore feet—the only animal in its fore parts entirely reſembling a quadrupede, and in its hinder parts approaches the nature of fiſhes, having a ſcaly tail—its deſcription—has but one vent for the emiſſion of excrements and urine—they aſſemble about the months of June and July—make a ſociety to continue the greateſt part of the year—form a company of above two hundred—fix their abode by the ſide of a lake or river—cut with their teeth a tree thicker than a man's body—amazing works and manſion houſes—convey their materials by water—mix clay and dry graſs together, work it into a mortar, and with their tails plaiſter their work within and without—their walls perpendicular, and two feet thick—their piers fourſcore or an hundred feet long, and ten or twelve feet thick at the baſe—their dikes ten and twelve feet thick at the foundation—their apartments round, or oval, and divided into three ſtories, one above the other viſited too often by men, they work only in the night-time, or abandon the place, and ſeek a ſafer ſituation—four hundred reſide in one manſion houſe, divided into a number of apartments, having communication with each other—their works in the northern parts finiſhed in Auguſt or September—in ſummer they are epicures—their proviſions for the winter ſeaſon—they drive piles into the earth, to fence and fortify their habitation againſt the wind and water—cut down branches from three to ten feet in length—the largeſt are conveyed to the magazines by a whole body—the ſmalleſt by one only—each taking a different way, and having a walk aſſigned him, that no one ſhould interrupt another in his work—wood-yards larger or ſmaller, in proportion to the number in family—manner of catching them in ſnares, or by ſurprize—they ſwim with their morter on their tails, and their ſtakes between their teeth—their works damaged by force of water, or feet of huntſmen, inſtantly repaired, iv. 157 to 167

Beauty, every country has peculiar ideas of beauty—extraordinary taſtes for beauty, ii. 76—every nation, how barbarous ſoever, has peculiar arts of heightening beauty—ſeveral of theſe arts, 78—a modern lady's face formed exactly like the Venus of Medicis, or the ſleeping

Veſtal, would ſcarce be conſidered as a beauty, except by the lovers of antiquity—leſs in the object than in the eye of the beholder—ſuperior beauty of our anceſtors not eaſily comparable, 265

Beccafigo, a bird of the ſparrow kind, v. 314

Bed of a river, an increaſe of water there increaſes its rapidity, except in caſes of inundation, and why —ſuch bed left dry for ſome hours by a violent ſtorm blowing directly againſt the ſtream, i. 207

Beds, the earth every where in beds over beds, and each of them maintaining exactly the ſame thickneſs, i. 58

Bee, a ruminating inſect, or ſeemingly ſo—its ſtomach is compoſed of muſcular fibres, iii. 6—operations ſtudie for two thouſand years are ſtill incompletely known— Reaumur's account ſufficiently wonderful—many of th facts held dubious by thoſe converſant with the ſubject—ſome declared not to have exiſtence in natur —three different kinds of bees—common working bee neither male nor female—queen bees lay all the egg that are hatched in a ſeaſon—ſtructure of the workin bee, particularly of its trunk, which extracts the honey from flowers—manner of building their cells—i one day, they make cells upon each other enough t contain three thouſand bees—deſcription of thoſe cell —the combs made by inſenſible degrees, not at once as ſome imagine—the cells for the young and for th drones—that for the queen bee the largeſt of all—thoſ for honey are deeper than the reſt—that not the onl food upon which they ſubſiſt—manner of anticipatin the progreſs of vegetation—the bee has a ſtomach fo wax as well as honey—bee-bread—treacle for food o bees in winter—what part of the flower has the hone —ſting of the bee—any wanting food, bends down it trunk to the bee from whom it is expected, which the opens its honey-bag, and lets ſome drops fall into th other's mouth—numerous as the multitude of bees appear in a ſwarm, they all owe their origin to one parent called the queen bee—opening the body of a queen the eggs at one time found to amount to five thouſand—the queen eaſily diſtinguiſhed from the reſt— great fertility of the queen, and the great attentions pai to her, controverted by recent obſervers—they leave a cell to every egg, and deſtroy the reſt—great care and affection for the young—in about twenty days after the egg was laid, the bee was completely formed, and fitted to undergo the fatigues of its ſtate—the cell being prepared, the animal ſoon transformed into an aurelia different from that of the common caterpillar—when they begin to break their priſons, above a hundred are excluded in one day—dreadful battles often enſue between the young brood and their progenitors—ſigns previous to their migrations—after the migration, the queen being ſettled, the ſwarm follows, and in a quarter of an hour the whole body is at eaſe—ſometimes ſacrifice their queen; but never when the hive is full of wax and honey—the working ſort kill the drones in the worm ſtate, in the cell, and eject their bodies from the hive among the general carnage—upwards of forty thouſand bees found in a ſingle hive—inſtances of expedition in working—in the firſt fifteen days, they make more wax than during the reſt of the year—a hive ſending out ſeveral ſwarms in the year, the firſt always the beſt and moſt numerous—a kind of floating bee-houſe uſed in France, viii. 65 to 87

Bees, in other countries—in Guadaloupe are leſs by half than in Europe, and have no ſting—ſometimes there are two or three queens to a ſwarm; then the weaker deſerted for the more powerful protector—the deſerted queen does not ſurvive the defeat—is deſtroyed by the jealous rival; and till this be done, the bees never go out to work—at Guadaloupe their cells are in hollow trees, ſometimes with a ſort of waxen-houſe, ſhaped like a pear, in which they lodge their honey, and lay their eggs—their honey never congeals, is fluid as oil, and has the colour of amber—in the tropical climates are black bees without a ſting—their wax is ſoft, and only uſed for medicinal purpoſes, not being hard enough for candles, as in Europe—whether the humble bees have a queen or not, there is one much larger than the reſt, without wings, without hair, all over black, like poliſhed ebony—this views all the works, from time to time—their habits—the honey gathered by the humble bees neither ſo fine, ſo good, nor the wax ſo clear, or ſo capable of fuſion, as thoſe of the common bees, viii. 84 to 92

Leaf-cutting Bees make their neſt, and lay their eggs among bits of leaves, viii. 94

Wall-bees, ſo called, becauſe they make their neſts in walls—the male and females are of a ſize—the former without a ſting, viii. 94, 95

Wood-bee—Maſon-bee, viii. 92—*Ground-bee* builds its neſt in the earth—the patience and aſſiduity of their labour, 93

Beetles, a ruminating inſect, or ſeems to ruminate, iii. 6—their general characteriſtics, viii. 128—their kinds diſtinguiſhed from each other—deſcription of the dorr-beetle, or the May-bug—how the two ſexes in the May-bug are diſtinguiſhed from each other—ſeaſon of their coupling—the female bores a hole into the ground, where to depoſit her burthen; and when lightened of it aſcends from the hole, to live as before—their eggs—deſcription of the inſect, and its manner of life in the worm-ſtate—continues in that ſtate for more than three years, changing every year its ſkin, and living under the ground without eyes—in what manner it aſſumes the form of a chryſalis—time when it becomes winged, and completely formed—the old one never ſurvives the ſeaſon—and dies from the ſeverity of cold in winter—its habits and food, when completely formed—number of their eggs—rooks and hogs particularly fond of them, and devour them in great numbers—inſtances of great devaſtations made by the May-bug—deſcription and habits of that beetle, which the Americans call the tumble-dung—the inſect called king of the beetles—deſcription of the elephant-beetle—the largeſt of this kind hitherto known, viii. 128 to 139

Beggars, a queſtion in the ſchools, which the moſt happy man, the beggar by night, and king by day; or the beggar by day, and king by night, ii. 139

Belcher (Mr.) See *Blood*, ii. 194

Bell, the great diving-bell improved by doctor Halley—he could write or read in it when the ſea was clear, and eſpecially when the ſun ſhone, i. 291

Bell, when the ſtag cries, he is ſaid to bell, iii. 113

Bells, their vibrations not heard under the receiver of an air-pump, i. 334

Berries, the Laplanders drink water, in which juniper-berries have been infuſed, ii. 216

Bewailer, or the ſai, a monkey of the new continent, iv. 236

Bezoar, German bezoar, iii. 69

Bezoar-goat, the oriental bezoar, iii. 74, & ſeq.—cow-bezoar, and monkey-bezoar, 76—hog-bezoar, 77

Billitting, a name given by huntſmen to the excrement of the fox, iii. 328

Birch, hares are particularly fond of it, iv. 7

Birds, all produced from the egg, ii. 26—their lower eye-lid alone has motion, 85—have the neck longer than any other kind of animals—thoſe which have ſhort claws, have alſo ſhort necks—thoſe that have long claws have the neck in proportion, 102—have a power of diſgorging food to feed their young—ruminating birds, iii. 5—many kinds which the dog will not touch, 304—hunters often informed by the birds of the place of retreat of the fox, 331—a flock of ſmall birds often alarms every thicket, and directs the hunter to the martin, 372—ſurpaſs fiſhes and inſects in ſtructure of body, and in ſagacity—their anatomy and conformation—compared to a ſhip making way through water—are furniſhed with a gland behind, containing a proper quantity of oil—to what purpoſe—deſcription of their feathers, v. 2 to 6—the pectoral muſcles of quadrupedes trifling to thoſe of birds—chuſe to riſe againſt the wind—and why—all, except the nocturnal, have the head ſmaller, and leſs in proportion to the body, than quadrupedes—their ſight exceeds moſt other animals, and excels in ſtrength and preciſion—have no external ear ſtanding out from the head—the feathers encompaſſing the ear-holes, ſupply the defect of the exterior ear—the extreme delicacy of their ſenſe of hearing, is eaſily proved by their readineſs in learning tunes, or repeating words, and the exactneſs of their pronunciation—their delicacy in the ſenſe of ſmelling—inſtance of it in ducks—the tail guides their flight like a rudder, and aſſiſts them either in the aſcent, or deſcent—wonderful internal conformation—the wind-pipe often makes many convolutions within the body of the bird, and is then called the labyrinth—of what uſe theſe convolutions are, no naturaliſt has been able to account—this difference obtains in birds to all appearance of the ſame ſpecies—whence ſome derive that loud and various modulation in their warblings is not eaſily accounted for—birds have much louder voices, in reſpect to their bulk, than animals of other kinds—all have properly but one ſtomach, but different in different kinds—the organs of digeſtion in a manner reverſed in birds—why they pick up ſand, gravel, and other hard ſubſtances—moſt have two appendices or blind guts—in quadrupedes always found ſingle—all birds want a bladder for urine—their urine differs from that of other animals—effects of the annual molting which birds ſuffer—their molting time artificially accelerated—and how—the manner in which nature performs the operation of molting—their molting ſeaſon—many live with fidelity together for a length of time—when one dies, the other ſhares the ſame fate ſoon after—the male of wild birds as happy in the young brood as the female—nothing exceeds their patience while hatching—Addiſon's obſervations to this purpoſe—great care and induſtry in providing ſubſiſtence for their young—they feed each of the young in turn—and why—perceiving their neſts or young to have been handled, they abandon the place by night, and provide a more ſecure, though leſs commodious retreat—the young taught the art of providing for their ſubſiſtence, v. 8 to 29—thoſe hatched and ſent out earlieſt in the ſeaſon the moſt ſtrong and vigorous—they endeavour to produce early in the ſpring, and why—efforts for a progeny when their neſts are robbed—ſuch as would have laid but two or three eggs, if their eggs be ſtolen, will lay ten or twelve—the greateſt number remain in the diſtricts where they have been bred; and are excited to migration only by fear, climate, or hunger—cauſe of the annual emigrations of birds—times of migrations—in what order performed—follow the weather rather than the country, and go on as they perceive the atmoſphere more ſuitable to their wants and diſpoſitions—in all countries, longer-lived than quadrupedes or inſects of the ſame climate—ſurpriſing age of ſwans and geeſe—plumage and voice of birds in different zones—all leſs than quadrupedes—the greateſt of one claſs ſurpaſs the greateſt of the other in magnitude, 30 to 39 — cauſes of the great variety in the middle order of birds—the oſtrich is the greateſt of birds—the humming-bird the ſmalleſt—wild birds generally of the ſame magnitude and ſhape—inferior to quadrupedes in docility—the number already known above eight hundred—difference between land-birds and water-fowls—deſcription of birds of the rapacious kind—the pie kind -- the poultry kind—the ſparrow kind — the duck kind—the crane kind, 40 to 45—the nauſeous bird, or dodo, 77—powers of land-birds of the rapacious kind to obtain their food—ſight of ſuch as prey by day ſurpriſingly quick—ſuch as ravage by night have their ſight fitted to ſee in darkneſs with preciſion—inhabit the moſt lonely places and deſert mountains—appearing in cultivated plains, or the warbling groves, is for depredation—every order of carnivorous birds ſeek for thoſe of the ſize approaching their own—the carnivorous kinds only breed annually, and are leſs fruitful than others—breed but few at a time —where ſupplies of food are difficult, the old ſoon drive the brood from the neſt to ſhift for themſelves, and often deſtroy them in a fury cauſed by hunger —almoſt all birds of prey unſociable—the male and female when neceſſary to each other live together; but they moſt uſually prowl alone—birds with crooked beaks and talons are ſolitary—all males of prey are leſs, and weaker than the females—the females are of a greater ſize, more beautiful and lovely for ſhape and colours, ſtronger, more fierce and generous, than the males—it may be neceſſary to be thus ſuperior, to provide for herſelf and her young—theſe birds are lean and meagre—their fleſh is ſtringy and ill-taſted, ſoon corrupting, and flavoured of that animal upon which they ſubſiſt—Belonius aſſerts, many people like the fleſh of the vulture and falcon, and dreſs them for eating; and that the oſprey, when young, is excellent food—five kinds of land-bird, of a rapacious nature—whence their diſtinctive mark, 80 to 85 -- bird of heaven, name given by the ancients to the eagle, 90—the moſt formidable birds of prey reſpect the butcher-bird, 134—the digeſtion of ſuch as live upon mice, lizards, or the like food, not very perfect, 142—father Kircher ſet the voices o birds to muſic, 143—domeſtic birds, of the poultry kind, maintained in our yards, are of foreign extraction, 151—the wilder ſpecies cooped or caged, pine away, grow gloomy, and ſome refuſe all ſuſtenance — th poultry kind alone grow fat, 154—climate, food, an captivity, three very powerful agents in the alteration in the habits, and the very form of birds—of all bird the cock the oldeſt companion of mankind, and th firſt reclaimed from the foreſt, 158—alſo the Perſia bird of Ariſtophanes, 161—deſcription of the tami or the bird of Numidia, 193—the buſtard the large land-bird, native of Britain, 194—none ſecures its young better from external injury than the toucan, 246—God' bird, the bird of paradiſe, 260—parakeets the moſt beautiful in plumage, and the moſt talkative birds in nature, 281—the pigeon, for its ſize, has the largeſt crop, 28 —ſmall birds mark out a territory to themſelves, which they permit none of their own ſpecies to remain in— at ſome ſeaſon of the year, all ſmall birds migrate from one county to another, or from more inland province towards the ſhore—months of their migrations—Autumn the principal ſeaſon for catching theſe wanderer —the nets, and the method of catching them—ſlur- birds—ſinging among birds univerſally the prerogativ of the male—ſmall birds fight till one yields his life with the victory—two male birds ſtrive in ſong, till the loude ſilences the other; during the contention, the femal ſits an attentive ſilent auditor, and often rewards th loudeſt ſongſter with her company during the ſeaſon— the male, while his mate is hatching, ſits upon ſom neighbouring tree, to watch and to ſing—the neſt o ſmall birds warmer than of the larger—ſmall birds having finiſhed their neſts, nothing exceeds the cunnin they employ to conceal it—worms and inſects the fir food of all birds of the ſparrow kind—how birds o the ſparrow kind bring forth and hatch their young— manner of life during the rigours of winter—the mal of ſmall birds not finding a mate of his own ſpecies flies to one of another like him, left out in pairing— mixed ſpecies between a goldfinch and a canary bird, tween a linnet and a lark; theſe breed frequently to ther, and produce not, like the mules among quadrupedes, a race incapable of breeding again, but one as fruitful as their parents—various birds of the ſparrow kind—many plants propagated from the depoſitions of birds—many of thoſe kinds, which are of paſſage in England, permanent in other countries; and ſome with us conſtant reſidents, in other kingdoms have the nature of birds of paſſage—inſtances of it, 301 to 319—the heron commits the greateſt devaſtation in freſh waters, 394—the flamingo has the largeſt tongue, vi. 15—birds of various ſorts and ſizes, more than the ſtars in a ſerene night, ſeen in the rock of the Baſs, in the Firth of Forth, 72—none make a more indifferent figure upon land, or a more beautiful in the water, than the ſwan, 113—of all birds known, it is the longeſt in the ſhell, 119—an inconteſtible proof that birds have their manners rather from nature than education, 127

Bird catchers, ſport by counterfeiting the cry of the owl, v. 144—nets for, and method of taking ſmall birds, 304

Biſon and *Urus*, names of deſcendants of one common ſtock—error of the naturaliſts upon this point—the cow and biſon are animals of the ſame kind—deſcription of the biſon—it is ſuppoſed by Klein and Buffon no more than another name for the bonaſus—the breed found in all the ſouthern parts of the world—that breed more expert and docile than ours—many bend their knees to take burdens up or ſet them down—the reſpect for them in India degenerated into adoration—it is nimble of foot—is eſteemed by the Hottentots—aſſiſts them in attending their flocks and guarding them againſt invaders—is taught to combat the enemies of the nation, and every army of the Hottentots is furniſhed with a herd of them—they procure the Hottentots an eaſy victory before they ſtrike a blow—lives in the ſame cottage with its maſter, and when it dies, a new one is choſen to ſucceed it by a council of the old men of the village, and is then joined with a veteran of its own kind, from whom it learns, becomes ſocial and diligent, and is taken for life into friendſhip and protection—the biſons are found to differ from each other in ſeveral parts of the world—ſome have horns, ſome are without—they are equally tractable and gentle when tamed—and are furniſhed with a fine, luſtrous, ſoft hair, more beautiful than that of our own breed—their hump of different ſizes, weighing from forty to fifty pounds, more or leſs—cuts and taſtes ſomewhat like a dreſſed udder—the biſons of Malabar, Abyſſinia, Madagaſcar, Arabia, Africa, and America---in the courſe of a few generations, the hump wears away--- its deſcription---the biſon and the cow breed among each other---the grunting or Siberian cow, and the little African cow or zebu are different races of the biſon, iii. 15 to 32

Bitch, a pregnant bitch, ſo placed by Mr. Buffon, that her puppies were brought forth in warm water, ii. 53

Bitches, one forgotten in a country-houſe lived forty days without any other nouriſhment than the wool of a quilt ſhe had torn to pieces, iii. 304, 305

Bittern, or mire-drum, the ſolemnity of its evening-call cannot be deſcribed by words---they are calls to courtſhip or of connubial felicity---it differs from the heron chiefly in colour---its windpipe fitted for the ſound ---opinions concerning the cauſe of its boomings---never utters its call in domeſtic captivity---its reſidence---a retired timorous animal---its food, neſt, and eggs---in three days, leads its little ones to their food---differences between the bittern and the heron---its hollow boom conſidered by the vulgar as the preſage of ſome ſad event---inſtance of it---its fleſh greatly eſteemed among the luxurious---it ſeldom riſes but when almoſt trod upon ---at the latter end of autumn, in the evening, its wonted indolence forſakes it---is then ſeen riſing in a ſpiral aſcent, till quite loſt from the view, making a ſingular noiſe different from its former boomings---names given to this bird by the Greeks and Latins, vi. 2 to 5

Bivalve ſhells, vii. 12---all the kinds hermaphrodite, yet require no aſſiſtance towards impregnation, 41--- particularly in theſe ſhell-fiſh the pearls are found, 53

Black-bird, of the ſparrow kind, v. 314

Black-bird, ſometimes ſeen all over white---its eggs and neſt, v. 321

Black-cap, bird of the ſparrow kind, v. 317---prized by ſome for its ſinging, and is alſo called the mock nightingale, v. 335

Blacks, conjectural opinion that the blacks are a race of people bred from one man accidentally black---the climate a cauſe obvious and ſufficient to produce blackneſs---nothing ſatisfactory diſcovered upon the cauſe producing it in human complexions--opinion of ſir Thomas Brown upon the ſubject, ii. 233 to 235---whence originally their flat noſes, 239---black parents have procreated two white negroes, 240

Bladder, birds have no bladder for urine, v. 17. See *Fiſhes*, vi. 171, 175

Blennius, or *Blenny*, deſcription of this fiſh, vi. 177, 306

Blind, ſuch as live in countries generally covered with ſnow become blind, ii. 160---the mole not blind, iv. 92

Blindworm, its deſcription, vii. 221

Blood, arterial blood immediately mixed with air in the lungs, is of a fine florid ſcarlet colour---that of the veins returning to the heart is of a blackiſh crimſon hue---whence this difference of colour proceeds not well underſtood, i. 332---the blood circulates through the bones, as through every other part of the body—Mr. Belcher the firſt who diſcovered it—his experiment to this purpoſe, ii. 194—blood of the rein-deer preſerved in ſmall caſks for ſauce with the marrow in ſpring, iii. 167---the heat of the blood in man and other animals about thirty degrees above congelation---in the marmout, and other animals which ſleep the winter it is not above ten degrees, iv. 45

Blue-bird, deſcribed, v. 321---its reſidence---is rarely caught---its docility---ſpeaks and whiſtles at the word of command---manner of taking it, 322

Blue-cat, deſcribed, iii. 211, 212

Bluſhing, whence it proceeds, ii. 93

Boar, wild, varies not his colour as hogs of the domeſtic kind, iii. 172—deſcription—he plows the ground like a furrow—his tuſks ſeen almoſt a foot long—they differ from thoſe of the elephant in that they never fall—when the boars come to a ſtate of maturity, they dread no ſingle creature—their poſition when attacked—the manner of hunting them—when killed, the teſticles cut off to prevent their tainting the fleſh—was formerly a native of our country—William the Conqueror puniſhed with the loſs of their eyes, ſuch as killed it in his foreſts—at preſent the wild breed is extinct, 172 to 180—the Canary boar deſcribed, 196—the tuſks being broken away, the animal abates i fierceneſs and venery, and nearly the ſame effect castration is produced, 197—does not fly the approac of the lion—combat of a lion and a wild boar, in meadow near Algiers, 226

Bobak, name of the marmout in Poland, iv. 48

Bodies, why ſome light bodies ſwim, and ponderou bodies ſink, i. 189—the deeper a body ſinks, th greater the reſiſtance of the depreſſed fluid beneath—how then, after it is got a certain way, does it ſink all, 191—animal bodies left to putrefy, produce air copiouſly, 337—ſymmetry of the human body—the bod of a well-ſhaped man ought to be ſquare, ii. 79, 80—human body often found to differ from itſelf in ſize—inſtance of it—the cauſe—differs alſo from itſelf i weight—inſtances of it, 108 to 110—thoſe parts furniſhed with the greateſt quantity of nerves, are firſt i formation, 146—the tone of a ſonorous body made t depend upon the number of its vibrations, and no the force, is taking an effect for a cauſe, 164—ſuffering is but to a certain degree—torture becoming exceſſive, deſtroys itſelf; and the mind ceaſes to perceive when the body can no longer endure, 207

Boerhaave taxed with marking out to his pupils a little ridge of hills in Holland, as mountains of no ſmall conſideration, i. 136

Boiguacu, the largeſt of the ſerpent kind in South America—ſometimes forty feet in length, ii. 6—deſcription of this creature, vii. 226

Bonaſus, ſuppoſed by Klein and Buffon another name for the biſon, iii. 18

Bones, in the embryo, ſoft almoſt as the muſcles and fleſh, ii. 193—hard as the bones ſeem, the blood holds its current through them, as through other parts of the body—in old age, more ſolid, alſo more brittle, and why, 193 to 195—foſſile bones found on the banks of the Ohio, in Peru, and Braſil, iv. 282, 283. See *Blood*, ii. 194. See *Bread*, ii. 216. See *Fiſh*, vi. 318, 319

Bonet-Chinois, Mr. Buffon's name of a monkey, ſuppoſed a variety of that called malbrouk, iv. 233

Bonito, deſcription of this fiſh, vi. 314

Booby, name given by our ſeamen to birds of the penguin tribe, vi. 96

Borandians, deſcription of them, ii. 213, 214

Boriſthenes, or Nieper, a river, its courſe and ſource, i. 210

Borneo, the natives hunt the ouran-outang in the ſame manner as the elephant or the lion, iv. 203

Baroch, in the kingdom of Cambaya, flocks of peacocks ſeen in the fields near that city, v. 175

Boſphorus, (the Thracian) was the firſt appropriated, by granting to ſuch as were in poſſeſſion of its ſhore the right of fiſhing in it, i. 232

Bottom of the ſea in ſome parts not found, and why—that of the Red Sea, a foreſt of ſubmarine plants—that of the ſea near America covered with vegetables—a map of the bottom of the ſea between Africa and America, by M. Buache, i. 288 to 290

Borneo, iſland in the Eaſt Indies, where the barbyroueſſa, or Indian hog, is principally found—hog of Borneo, the name given by travellers to the babirouefſa, iii. 192

Bowels of the ruminating animals conſidered as an elaboratory with veſſels in it, iii. 3

Boyuna, of Ceylon, a kind of ſerpent, vii. 223

Brain and ſpinal marrow the firſt ſeen in the embryo, ii. 146—earth worm entirely without it, viii. 168—ſome animals live without their brain for weeks, 170

Brambling, bird of the ſparrow kind, v. 315, 317

Bramins of India have a power of ſmelling equal to moſt creatures---they ſmell the water they drink, through to us quite inodorous, ii. 180

Braſil, black clothes worn there ſoon turn of an iron-colour---kept in the ſhops, preſerve their proper hue, i. 314---duck deſcribed, vi. 130

Bread, twelve ounces of it, and nothing but water, the common allowance, for four and twenty hours, among the primitive Chriſtians of the Eaſt, ii. 132---that of the Laplanders compoſed of bones of fiſhes, pounded and mixed with the inſide tender bark of the pine-tree, 216

Bream, deſcription of the ſea-bream, vi. 308

Breaſts in women larger than in men---milk found in breaſts of men as well as of women, ii. 102---black women's breaſt, after bearing one child, hang down below the navel---it is cuſtomary among them to ſuckle the child at their backs, throwing the breaſt over the ſhoulder, 228

Breath of the lion is very offenſive, iii. 224---manner of breathing in fiſhes, vi. 170

Breeze, conſtant breeze produced by the melting of ſnows, i. 347---from ſea encreaſes gradually till twelve, ſinks away, and totally huſhed at five---upon its ceaſing, the land breeze begins, encreaſes till twelve at night, and is ſucceeded in the morning by the ſea-breeze---cauſe of theſe two breezes---ſometimes theſe ſea and land breezes come at all honrs---the land and ſea-breezes on the coaſts of Malabar and at Congo, 350, 351

Briſſon, his method of claſſing animals, ii. 298

Briſtol, a citizen of it who ruminated his food, iii. 6

Britons, the ancient, conſidered the hare as an unclean animal, and religiouſly abſtained from it, iv. 14---the cock a forbidden food among them, v. 161

Broches, the horns of the ſtag the firſt year, iii. 113

Brock, the ſtag of the third year, iii. 113

Brown (ſir Thomas) hoped one day to produce children by the ſame method as trees, ii. 26---his opinion upon the cauſe of blackneſs in human complexions, 235

Brun (Le) giving a painter directions about the paſſions, places the principal expreſſion of the face in the eye brows, ii. 84

Bruſh, the name given by huntſmen to the tail of the fox, iii. 328

Brutes, in thoſe countries where men are moſt barbarous and ſtupid, brutes are moſt active and ſagacious, iv. 231

Bubalus, an animal partaking of the mixed natures of the cow, the goat, and the deer, iii. 79---its deſcription---has often been called the Barbary cow, from which it differs widely, 80

Bubalus, properly a gazele of Africa, iii. 149

Bubalus, of the ancients, ſuppoſed of the cow kind by Buffon, placed among the lower claſs of ruminant quadrupedes, iii. 18

Buccinums, one or two of them viviparous, vii. 30

Buck, capable of propagating at the age of one year---one buck ſufficient for an hundred and fifty goats---becomes old before his ſeventh year, iii. 55---hunting the buck and the ſtag performed in the ſame manner in England, 112—number of names invented by hunters for this animal---does not change his layer, like the ſtag---manner of hunting him is much the ſame as that of ſtag-hunting, 128

Buck-goat produces with the ewe an animal that, in two or three generations, returns to the ſheep, retaining no mark of its ancient progenitor, iii. 35

Buffalo, of the varieties of the cow kind, but two are really diſtinct, the cow and the buffalo---they bear an antipathy to each other----they do not breed among each other, and no animals are more diſtinct and like each other leſs---are in abundance in Guinea and Malabar---it is a great ſwimmer---deſcription of it---the veal of the young is not better eating than the beef of the old---they are natives of the warmer climates---yet are bred in ſeveral parts of Europe, particularly in Italy---the female produces one at a time---continues pregnant for twelve months---is afraid of fire---leather made of its hide is well known for thickneſs, ſoftneſs, and impenetrability---guided by a ring thruſt through its noſe---milk of the female not ſo good as of the cow---two buffaloes yoked draw more than four ſtrong horſes---its fleſh hard and blackiſh, diſagreeable to taſte and ſmell---this animal wild in many parts of India, and dangerous---manner of hunting them—when tamed, no animal more patient or humble---inferior in ſize only to the elephant, the rhinoceros, or hippopotamos---the camelopard, or camel, if taller, neither ſo long, nor ſo corpulent---is fond of the water, and croſſes the largeſt rivers without difficulty---has an averſion to red colours that reſemble flame---in thoſe countries where they are in plenty no perſon dreſſes in ſcarlet---they make moſt uſe of their feet in combat, and rather tread their enemies to death than gore them, iii. 18 to 30

Buffon, (M.) his theory of the earth, and a detail of ---queſtions that might be aſked this moſt ingenious philoſopher concerning his theory of the earth—he has brought together a multitude of facts relative to the hiſtory of the earth, i. 33 to 39—his ſyſtem about the rudiments of animals, ii. 19—objections againſt it, 20—thinks that women never become bald, 86—his deſcription of the firſt ſenſations of a man juſt brought into exiſtence, pointing out the ſteps by which he arrived at reality, 187, 188

Buffoon-bird, name our ſailors give the Numidian crane—its peculiar geſtures and contortions—the French call it demoiſelle—it is a very ſcarce bird—the ancients have deſcribed a buffoon-bird, but not meant the Numidian crane, v. 390 to 391

Bug, the May-bug, viii. 130. See *Beetles*.

Bugs, their habits—deſcribed—are often found coupling tail to tail—manner of deſtroying them—they deſtroy fleas, and devour each other, vii. 281 to 285

Bulbous, hair is ſo at the root, ii. 87

Bulin, a ſea-ſnail, performs the offices of male and female at the ſame time, vii. 31

Bull, the gimerro, aſſerted to be between the aſs and the bull, ii. 386

Bullfinch, bird of the ſparrow kind, v. 315, 317—may be taught to whiſtle a regular tune, 345

Bull-head, deſcription of this fiſh, vi. 309

Bulls, the wild, in Spain, mean deſpicable animals—have nothing of that ſternneſs of aſpect remarkable in our bulls, iii. 20

Bull's-eye, name given by ſailors to a terrible hurricane—deſcribed, i. 359

Bunting, bird of the ſparrow kind, v. 315

Burnet, his theory of the earth—a detail of that work, i. 22, 23

Buſtard, the largeſt land-bird that is a native of Britain—inhabits the open and extenſive plain—is much larger than the turkey, the male generally weighing from twenty-five to twenty-ſeven pounds—its deſcription—its food—places where frequently ſeen in flocks of fifty or more—they have always centinels placed at proper eminences, ever on the watch, to warn the flock of the appearance of danger—are often run down by greyhounds—in what manner—ſeldom wander above twenty or thirty miles from home—the males have a pouch, holding near ſeven quarts of water—they change eir mates at the ſeaſon of incubation, about the latter nd of ſummer—ſeparate in pairs, if there be a ſuffiiency of females for the males; otherwiſe the males ght until one of them falls—in France, ſome of thoſe ictims of gallantry found dead in the fields—their eſts—they lay two eggs, almoſt the of ſize of a gooſegg—hatch for about five weeks—the young run about s ſoon as out of the ſhell—they aſſemble in flocks in ctober, and keep together till April—their food in inter—in parts of Swiſſerland, they are found frozen n the fields in ſevere weather—when taken to a warm lace, they again recover—uſually live fifteen years, and e incapable of being propagated in a domeſtic ſtate, v. 94 to 198

Butcher-bird, its deſcription, with its habits—leads a ife of continual combat—intrepidity of this little creaure, in going to war with the pie, the crow, and the eſtril, all above four times bigger than itſelf—it fights pon the defenſive, and often comes to the attack with dvantage, particularly when the male and female unite o protect their young, and to drive away the more owerful birds of rapine—in what manner they ſally orth againſt them—ſometimes the combat ends with he deſtruction of the aſſailant, and alſo of the defender—the moſt redoubtable birds of prey reſpect them, and hey fly in their company without fearing their power, r avoiding their reſentment—ſmall birds are its uſual ood; and when it has killed the bird or inſect, as aſerted by the beſt authority, it fixes them upon ſome eighbouring thorn, and when thus ſpitted, pulls them o pieces with its bill—the ſmaller red butcher-bird igrates—the places where they are to be found—their eſts, and the number of their eggs—the female feeds er young with caterpillars and other inſects, but ſoon fter accuſtoms them to fleſh, procured by the male with reat induſtry—their nature very different from other irds of prey in their parental care; for, inſtead of riving out their young from the neſt to ſhift for themſelves, they keep them with care, and even when adult do not forſake them—the whole brood thus live in a family together—each family afterwards live apart, and hunt in concert—upon the returning ſeaſon of courtſhip, this union is at an end, the family parts for ever, each to eſtabliſh a little houſhold of his own—the manner of flying is always up and down, ſeldom direct or ſideways—different kinds of this bird, v. 132 to 136

Butter, the fat of the manati ſerves in all caſes inſtead of butter, iv. 186

Butterfly, ſome kinds actually live upon nothing, ii. 125—one of the principal ornaments of oriental poetry—in thoſe countries, the inſect is larger and more beautiful than with us, viii. 4—eaſily diſtinguiſhed from flies of every other kind by their wings—Linnæus has reckoned up above ſeven hundred and ſixty different kinds, yet the catalogue is incomplete—number and beautiful colours of its wings—butterflies can diſcover their mates at more than a mile's diſtance—deſcription of the head, corſelet, and body—the eyes have not all the ſame form; but the outward coat has a luſtre, in which may be diſcovered all the colours of the rainbow—when examined cloſely, it has the appearance of a multiplying glaſs—the uſe of their horns or feelers as yet unknown—uſe of their trunks—difference between butterflies and moths—they often perceive the approach of the female at above two miles diſtance; by what ſenſe is not eaſy to conceive—it has no organs for ſmelling—the female is larger than the male—if diſturbed while united, the female flies off with the male on her back, entirely paſſive upon the occaſion—after junction, they depoſite their eggs and die—all females of this tribe are impregnated by the male by one aperture, and lay their eggs by another—every butterfly chuſes for her brood, inſtead of the plant moſt grateful in its winged ſtate, that it has fed upon in its reptile form—how they keep their eggs warm, and alſo entirely concealed—many do not lay till the winter warns them of their approaching end—ſome continue the whole winter in hollows of trees, and do not provide for poſterity until the beginning of April, then leave their retreats, depoſite their eggs, and die, 32 to 42. See *Aurelia*, viii. 26, 27

Buttock, in man, different from that of all other animals, ii. 105.

Buzzard, a ſluggiſh inactive bird, often remains perched whole days upon the ſame bough—lives more

upon

upon frogs, mice, and inſects, than upon birds more troubleſome to ſeize—its manner of living in ſummer—ſo little capable of inſtruction, that it is a proverb to call one obſtinately ignorant, a buzzard—the honey-buzzard, the moor-buzzard, and the hen-harrier, are of this ſtupid tribe, and differ chiefly in their ſize, v. 130

Byron (Commodore) our laſt voyager that has ſeen the gigantic race of mankind, ii. 261

C.

Cabiai, the ſame animal as the capibara, iii. 189

Cachalot, a fiſh ſaid to purſue a ſhoal of herrings, and to ſwallow thouſands at a gulp, vi. 164—it has generally gone under the name of the ſpermaceti whale, till Mr. Pennant made the diſtinction, borrowing its name from the French—ſeven diſtinctions in this tribe—deſcription—the throat of this animal very formidable—with eaſe it could ſwallow an ox—it can at one gulp ſend a ſhoal of fiſhes down its enormous gullet—it terrifies the dolphins and porpoiſes ſo much, as often to drive them on ſhore—it contains two precious drugs, ſpermaceti and ambergriſe—the oil of this fiſh is eaſily convertible into ſpermaceti, by boiling it with a ley of pot-aſh, and hardening it in the manner of ſoap—candles are now made of it—the balls of ambergriſe not found in all fiſhes of this kind, but chiefly in the oldeſt and ſtrongeſt, 212 to 216

Cagui, or the ſaki, is the largeſt monkey of the ſagoin kind—its deſcription, iv. 237

Cajeta, a mountain near it, was ſplit by an earthquake, i. 157

Cairo, in what manner they produce there ſix or ſeven thouſand chickens at a time, v. 168

Calao, the horned Indian raven, v. 235

Calcination, all animal ſubſtances when calcined are the ſame, vii. 111

Calf, name given to the young of the hind, or the female of the ſtag, iii. 108

Calf, or hind-calf; the ſtag called ſo the firſt year, iii. 113

Callitrix, the green monkey of St. Jago, of the ancient continent—its deſcription, iv. 234

Callyonymus, the dragonet—deſcription of this fiſh, vi. 300

Calms attended with deluges of rain—why, and where, i. 345

Camel, a ruminating animal, iii. 5—camel and dromedary not two diſtinct kinds, only a variety of the ſame, which has ſubſiſted time immemorial—the only ſenſible difference between thoſe two races, they produce with each other, and the mixed breed is conſidered the beſt—of the two the dromedary is far the moſt numerous—countries where the camel and dromedary are found—neither can ſubſiſt, or propagate, in the climates towards the North—Arabia the moſt adapted to the ſupport and production of this animal—the camel the moſt temperate of all animals—it can continue to travel ſeveral days without drinking, and is often ſix or ſeven days without any ſuſtenance—its feet formed to travel upon ſand, and utterly unfit for moiſt or marſhy places—many vain efforts tried to propagate the camel in Spain—they have been tranſported into America, but have multiplied in neither—they might perhaps produce in theſe countries, but would in a few years degenerate; their ſtrength and their patience would forſake them; and, inſtead of enriching, become a burthen to their keepers—uſes to which this animal is put among the Arabians—its education—it has a fifth ſtomach, as a reſervoir, to hold a greater quantity of water than immediately wanted—when the camel finds itſelf preſſed with thirſt, it throws up a quantity of this water, by a ſimple contraction of the muſcles, into the other ſtomachs—travellers, when ſtraightened for water, have often killed their camels for what they expected to find within them—countries where commerce is carried on by means of camels—trading journies in caravans—their food—purſue their way when the guides are utterly aſtray—its patience and docility when loaded—in what manner the female receives the male—one male left to wait on ten females, the reſt caſtrated—they live from forty to fifty years—every part of this animal converted to ſome uſeful purpoſe—its very excrements are not uſeleſs—their burthen, iv. 302 to 311

Cameleon, its dimenſions and appetites—has a power of driving the air it breathes over every part of the body—changes of its colour—it is an error that it aſſumes the colour of the object it approaches—deſcription of it by Le Bruyn—it often moves one eye, when the other is at reſt—ſometimes one eye ſeems to look directly forward, while the other looks backward; and one looks upward, while the other regards the earth, vii. 151 to 156

Camelopard deſcribed—dimenſions of a young one—inhabits the deſerts of Africa—no animal, from its diſpoſition, or its formation, leſs fitted for a ſtate of natural hoſtility—it lives entirely upon vegetables, and when grazing, ſpreads its fore legs wide to reach the paſture—known to the ancients, but rarely ſeen in Europe—often ſeen tame at Grand Cairo, in Egypt—Pompey exhibited at one time ten upon the theatre, iv. 298 to 300

Camerarius, his deſcription of the perfections a horſe ought to poſſeſs, ii. 372

Camlet made of the hair of animals about Angora, iii. 58

Canada, above thirty thouſand martins ſkins annually imported from that country into England, iii. 372

Canal. See *Blood*, ii. 194, 195. See *Fœtus*, vii. 58

Canary-bird, taught to pick up the letters of the alphabet at the word of command, to ſpell any perſon's name in company, v. 41—by the name, originally from the Canary Iſlands—come to us from Germany, where they are bred in numbers—at what period brought into Europe is not known—about a century ago they were ſold at very high prices, and kept only for the amuſement of the great—in its native iſlands it is of a duſky grey colour, and ſo different from thoſe ſeen in Europe, as to raiſe a doubt about its ſpecies—rules and inſtructions for breeding them in a domeſtic ſtate—apparatus for breeding it in Germany—food the old ones muſt be ſupplied with, when the young ones are excluded—ſo prolific are theſe birds ſometimes, that the female will be ready to hatch a ſecond brood, before the firſt is able to quit the neſt—this bird kept in company with the linnet or gold-finch, pairs, and produces a mixed breed, moſt like the canary-bird, and reſembling it in its ſong, 339 to 344

Canary boar deſcribed, iii. 196

Cancerous breaſts cured by the ſucking of the rubeth, or the land-toad, vii. 102

Candle quickly extinguiſhes in an exhauſted receiver, and why, i. 333

Cannons filled with water, and left to freeze, burſt, i. 179

Cantharis, well known in the ſhops by the name of Spaniſh flies, and for their uſe in bliſters—their deſcription, with the differences from each other—the countries where, and trees on which they are ſeen—it is reported, that the country people expect the return of theſe inſects every ſeven years—their bad ſmell is a guide to thoſe who catch them—they ſmell ſo diſagreeable, as to be perceived at a great diſtance, eſpecially about ſun-ſet, though not ſeen at that time—they yield a deal of volatile cauſtic ſalt—their qualities—the effects fall principally upon the urinary paſſages—in what manner they are killed, viii. 141 to 143

Cape de Verde iſlands—a ſouth wind prevails in them during the month of July, i. 346

Cape of Good Hope, a north-weſt wind blows there during the month of September, i. 346—at the Cape of Good Hope it is cuſtomary to hunt the elephant for its teeth, iv. 280—in what manner—account of an unhappy huntſman, 281

Capibara, or cabiai, an animal reſembling an hog of about two years old—its deſcription—ſome naturaliſts have called it the water-hog; and why—a native of South America, and chiefly frequenting the borders of lakes and rivers—like the otter it ſeizes the fiſh, upon which it preys, with its hoofs and teeth—lives alſo upon fruits, corn, and ſugar-canes—its cry reſembles the braying of an aſs, more than the grunting of a hog—its only place of ſafety is the water, into which it plunges when purſued; and keeps ſo long at the bottom, that the hunter can have no hopes of taking it there—when young is eaſily tamed—its fleſh has a fiſhy taſte; but its head is ſaid to be excellent, iii. 190 to 192

Capons taught to clutch a freſh brood of chickens throughout the year, v. 169

Capon of Pharaoh ſuppoſed the true ibis—is a devourer of ſerpents, and follows the caravans that go to Mecca, to feed upon the offal of the animals killed on the journey, v. 385

Caracal, or the ſyaguſh, a native of the Eaſt Indies, reſembles the lynx in ſize, iii. 258

Caracol, a town ſituated at the foot of the Andes, i. 147

Caraguata, a plant in the Weſt Indies, which clings round the tree it happens to be near—it keeps away that nouriſhment deſigned to feed the trunk, and at laſt entirely deſtroys its ſupporter, ii. 4

Carapo, deſcription of this fiſh, vi. 305

Caraſſa, a volcano in South America, i. 99

Caravan, a ſingle lion of the deſert often attacks an entire caravan, iii. 216—the aſſemblage called a caravan ſometimes compoſed of numbers amounting to ten thouſand, iv. 308

Carcajou, name given by the North Americans to the glutton—its manner of killing the rein-deer, iii. 170

Caribou, name the Americans give the rein-deer, iii. 153, 170

Carli (Father). See *Monkies*, iv. 230

Carnivorous animals, there is one claſs that purſue in a pack, and encourage each other by their mutual cries—ſupport a ſtate of famine for ſeveral weeks together—ii. 319 to 323—milk in thoſe animals is more ſparing than in others, ii. 337. See *Animals*, iii. 1 to 4

Carnivorous birds ſeek for ſuch as are of the ſize moſt approaching their own, v. 81. See *Birds*.

Carp, an experiment made with this fiſh in a large vaſe of water, under an air-pump, vi. 165, 167—one found by Buffon not leſs than a hundred years old—this diſcovery confirmed by other authors, 172—continues in the egg not above three weeks, 176—Mr. Tull famous for his invention of ſpaying carp to give it a fine flavour, 178—its deſcription, 308—the method of fattening it in a damp cellar—it has been known thus to live for a fortnight, to grow exceedingly fat, and to get a ſuperior flavour, 314

Carriers, pigeons uſed to carry letters, v. 291

Carrion-crow reſembles the raven in its appetites, it laying, and manner of bringing up its young, v. 230

Carteſius, his theory to explain the invariable motion of the winds, not quite ſo abſurd as that of doctor Lyſter, i. 342

Carthagena, in America—the heat of the climate affects the ſpeech of its inhabitants, which is ſoft and ſlow, and their words generally broken—more than three parts of our army deſtroyed by the climate, in our unſucceſsful attack upon it, i. 322

Carthamus, or baſtard ſaffron, ſtrongly purgative t man—parrots very ſond of it, v. 280, 281

Cartilage, the thyroid cartilage, ii. 102—catilages i youth elaſtic, and pliant in age, become at laſt har and bony; and why, 195

Cartilaginous fiſhes—their general conformation—ſuppoſed they grow larger every day till they die—thei internal ſtructure—are poſſeſſed of a two-fold power o breathing—apertures by which they breathe—the cartilaginous ſhark, or ray, live ſome hours after they ar taken—fiſhes of this tribe can remain under water without taking breath; and can venture their head above the deep, and continue for hours out of their native element—the ſeaſon and manner of copulating—and of bringing forth—little difference between the viviparous and the oviparous kinds, in this claſs of fiſhes—five diviſions of the cartilaginous fiſh, vi. 227 to 233

Caſſowary, a bird firſt brought into Europe by th Dutch from Java, in the Eaſt Indies, where only i is found—its deſcription—the part which moſt diſtinguiſhes this animal is the head, which inſpires ſom degree of terror—its internal parts deſcribed—it has th head of a warrior, the eye of a lion, the defence of porcupine, and the ſwiftneſs of a courſer—is not fierc in its natural character—how it defends itſelf—extraordinary manner of going—the Dutch aſſert that it ca devour glaſs, iron, and ſtones, and even live and burning coals, without the ſmalleſt fear, or the leaſt injur —the largeſt of its eggs is fifteen inches round one way and twelve the other—places where this animal i found—it has not multiplied in any conſiderable degree as a king of Java made a preſent of one to the captain of a Dutch ſhip, as a rarity, v. 68 to 74

Catacombs of Egypt, ii. 277

Catamountain, hunts for the hare or the rabbit, ii. 320—the ocelot of Mr. Buffon, iii. 255—its deſcription, 256—is one of the fierceſt, and, for its ſize, one of the moſt deſtructive animals in the world, 262

Catanea, a city utterly overthrown by an earthquake, i. 111, 112

Cataphractus, or kabaſſou, is one of the largeſt kinds of the armadilla, iv. 133

Cataracts of the Rhine, and of the Nile, i. 221—the cataract of the river Velino, in Italy, is above an hundred and fifty feet perpendicular—a cataract near the city of Gottenburg in Sweden—other cataracts, i. 222, 223

Cataract of the eye; Mr. Cheſelden having couched a boy of thirteen, who to that time had been blind, and at once having reſtored him to ſight, curiouſly marked the progreſs of his mind upon the occaſion, ii. 152 to 156

Caterpillars, their differences from all other inſects—all theſe animals are hatched from the eggs of butterflies—during winter, the greateſt number of caterpillars are in an egg ſtate—in the aurelia ſtate, they are ſeemingly deprived of life and motion—ſome do not make any change at the approach of winter, but chuſe themſelves ſome retreat, and there remain quite motionleſs, and as inſenſible as if actually dead—caterpillars of this kind are found in great numbers together, encloſed in one common web that covers them all—there are ſome of the kind, whoſe butterflies live all the winter, and where—a ſingle caterpillar eats double its own weight of leaves in a day, and ſeems no way diſordered by the meal—the body of the caterpillar anatomically conſidered—avidity with which they feed—number of their ſtigmata, or thoſe holes through which the animal is ſuppoſed to breathe—it has eighteen lungs—the experiment of Malphigi to aſcertain their uſe—all caterpillars ſpin at one time or another—many of them change their ſkins five or ſix times in a ſeaſon—and in what manner—change into an aurelia—their retreats in that ſtate,

viii. 4 to 23—there are thouſands of fiſhes, birds, and inſects, that live chiefly upon caterpillars—a ſingle ſparrow and its mate, that have young ones, deſtroy above three thouſand caterpillars in a week—ſome of the kind, fitted only to live upon leaves and plants, will eat each other, in preference to their vegetable food—the bodies of the larger kinds ſerve as a neſt to various flies, that very carefully depoſite their eggs in them—number of worms remain within the body of the caterpillar, devouring its entrails, without deſtroying its life—the ichneumon tribe is not the caterpillar's offſpring, as ſuppoſed, but its murderers, 43 to 48

Cat-fiſh, its deſcription, vi. 302

Cats, the wild hunt for the ſquirrel or the mouſe, ii. 320—the whole tribe ſeek their food alone, and never unite for mutual defence, nor for mutual ſupport—and, except at certain ſeaſons, are enemies to each other—all of the cat kind devour nothing but fleſh, and ſtarve upon any other proviſion—their greateſt force lies in the claws—the cat goes with young fifty-ſix days, and ſeldom brings forth above five or ſix at a time—the male often devours the kittens—before they are a year old, they are fit to engender—the female ſeeks the male with cries; nor is their copulation performed without great pain, and why—cats hunt the ſerpents in the iſle of Cyprus—any animal weaker than themſelves, is to them an indiſcriminate object of deſtruction—the mouſe is their favourite game, and they patiently watch a whole day, until the mouſe appears—a flagrant mark by which the cat diſcovers its natural malignity—their eyes ſee better in darkneſs than light, and why—if the inhabitant quits the houſe, the cat ſtill remains—is exceſſively fond of ſome plants, ſuch as valerian, marum, and cat-mint—particularly loves fiſh—its ſleep is very light—its hair ſends forth ſhining ſparks, if rubbed in the dark—the wild breed with the tame—deſcription of the wild cat—inhabits the moſt mountainous and woody parts, lives moſtly in trees, and feeds only by night—the cat was much higher in eſteem among our anceſtors than it is at preſent—laws of Howel, concerning the price of cats—cats were not naturally bred in our foreſts—of all quadrupedes, the wild cat is, perhaps, that whoſe inteſtines are proportionably the ſmalleſt and the ſhorteſt; and why—common to the new continent, as well as the old—the blue-cat—the lion cat, or, more properly, the cat of Angora—the cats in Syria and Perſia remarkable for their long ſoft hair, iii. 198 to 212—all the cat kind are kept off by the fires which the inhabitants light to preſerve their herds and flocks—and they hunt rather by the ſight than the ſmell—it happens that the lion purſues the jackal or the wild dog, while they are hunting upon the ſcent, and merely for themſelves; the lion is then an unwelcome intruder upon the fruits of their toil—from thence, probably, has ariſen the ſtory of the lion's provider—the lion devours a great deal at a time, and generally fills himſelf for two or three days to come—in the deſerts and foreſts, his moſt uſual prey are the gazelles and the monkeys, 222 to 224—the race of cats noxious in proportion to their power to do miſchief—inhabit the moſt torrid latitudes of India, Africa, and America, and have never been able to multiply beyond the torrid zone—they ſeldom attack man, though provoked—of all animals theſe are the moſt ſullen, and, to a proverb, untameable, 259—different claſſes of the kind, from the lion to the cat, 267, 268—the wild cat and the martin ſeldom meet without a combat—it is not a match for the martin, 369—the cat of Pharaoh injudiciouſly called the ichneumon, 376—cats of Conſtantinople, a name of the gennet, and why, 388

Cattle, we have the beſt breed of horned cattle in Europe, iii. 12—the large hornleſs breed in ſome parts of England, originally from Poland, 13—the Dutch bring great quantities of lean cattle from Denmark, to fatten on their own rich grounds—that of the Ukraine becomes fat, and is conſidered the largeſt breed of all Europe—in Switzerland theſe animals grow to a large ſize—not ſo in France, 19—ſize in Barbary, Ethiopia, Perſia, and Tartary, 20—leather-mouthed cattle, 45—liable to be deſtroyed by the South-American bat, vampyre, iv. 146

Caverns, the amazing cavern of Eldenhole in Derbyſhire—the dreadful cavern in the country of the Arrian Indians, called the Gulph of Pluto, deſcribed by Ælian

—cavern of Maeſtricht—its deſcription—no part of the world has a greater number of artificial caverns than Spain—in general deſerted by every race of meaner animals, except the bat—the cavens called Oakley-hole, the Devil's-hole, and Penpark-hole, in England—the cavern of Antiparos, and its diſcovery, i. 60 to 67—how natural caverns formed, 72—two hundred feet as much as the loweſt of them is found to ſink, 73—one in Africa, near Fez, continually ſends forth either ſmoke or flames, 99

Caviar, the inhabitants of Norway prepare from eggs found in the body of the porpeſſe, a ſavoury liquor, which makes a delicate ſauce, and is good when eaten with bread, vi. 223—it is made with the roe of ſturgeon—more in requeſt in other countries of Europe than with us—and is a conſiderable merchandize among the Turks, Greeks, and Venetians—manner of making it, 277

Cauſes, the inveſtigation of final cauſes a barren ſtudy; and, like a virgin dedicated to the deity, brings forth nothing, i. 20

Cauſtic, cantharides yield a great deal of volatile cauſtic ſalt, viii. 143

Cayman, a ſort of crocodile, vii. 119

Cayopolin, a kind of oppoſſum—its deſcription, iv. 248

Cea, an iſland waſhed away with ſeveral thouſand inhabitants, i. 134

Cells made by the bees, viii. 70, 71

Cenere, a mount of recent appearance, i. 162

Centinel. See *Animals*, ii. 324. See *Marmout*, iv. 43. See *Buſtard*, v. 196

Centipes, the ſcolopendra, vii. 302

Centriſcus, a kind of cartilaginous fiſh, vi. 286

Cephus, name given by the ancients to the monkey now called mona, iv. 234

Cepola, the deſcription of this fiſh, vi. 301

Cerigo, an iſland of the Archipelago, where many wild aſſes are found, ii. 377

Cetaceous fiſhes, the whale and its varieties reſemble quadrupedes in their internal ſtructure, and in ſome of their appetites and affections — they are conſtrained every two or three minutes to come up to the ſurface to take breath, as well as to ſpout out through their noſtril (for they have but one) that water which they ſucked in while gaping for their prey—the ſenſes of theſe animals ſuperior to thoſe of other fiſhes, and it is moſt likely that all animals of the kind can hear—they never produce above one young, or two at the moſt; and this the female ſuckles in the manner of quadrupedes, her breaſts being placed, as in the human kind, above the navel—diſtinctive marks of this tribe, vi. 181 to 186

Chace, men of every age and nation have made that of the ſtag a favourite purſuit—in our country it was ever eſteemed a principal diverſion of the great, iii. 109—theſe ſports reſerved by ſovereigns for particular amuſement, and when—in the reigns of William Rufus and Henry the Firſt, it was leſs criminal to deſtroy a human being than a beaſt of chace—ſacred edifices thrown down for room to beaſts of chace, 110—chace of the ſtag, as performed in England, 112, 116—terms uſed by hunters in that chace, 113, 114—the ſame in Sicily, 120—and in China, 121—chace of the fox—cant terms uſed by the huntſmen in it, 328—of all varieties, that of the oſtrich the moſt laborious, is alſo the moſt entertaining—deſcription of it, v. 59, 60

Chacrelas, white men go by that name in the Eaſt Indies, ii. 241

Chætodon, or the *cat-fiſh*, its deſcription, vi. 302

Chaffinch, a bird of the ſparrow kind, v. 315, 317, 318—time of emigration of the hen, v. 32

Chapotonadas, a diſtemper in America, i. 323

Charles XII. when ſhot at the ſiege of Fredericſhall, was ſeen to clap his hand on the hilt of his ſword, ii. 208

Charoſſi, the only ſort of horſes for hunting lions, iii. 226

Charybdis, a gulph—Nicola Peſce jumped into it, continued for three quarters of an hour below, and at laſt appeared holding a golden cup in one hand, and making his way among the waves with the other—deſcription of this gulph, i. 295, 297

Chaſms, amazing in the Alps, i. 59—and ſtill more in the Andes, 60—cauſes that produce chaſms or fiſſures, 62

Chatterer, a bird native of Germany—its deſcription, v. 242

Cheeſe, the inhabitants of Canada uſe no other than the milk of the hind, or the female of the ſtag, iii. 124—thoſe of Lapland little and well taſted, 165—never breed mites, 166

Cheops, the oldeſt meaſure of the human figure in his monument, in the firſt pyramid of Egypt, ii. 264

Cheſelden. See *Cataract*, ii. 152 to 156

Chevrotin, or little *Guinea deer*, the leaſt of all cloven-footed quadrupedes, and perhaps the moſt beautiful—is moſt delicately ſhaped—its deſcription—native of India, Guinea, and the warm climates between the tropics—the male in Guinea has horns; but the female is without any—they chiefly abound in Java and Ceylon, iii. 82, 83

Cheney, ſuſpected the quantity of water on the earth daily decreaſing, i. 182

Chicken, an amazing hiſtory of it in the egg, by Malpighi and Haller, ii. 28, et ſeq.—in what manner ſix or ſeven thouſand are produced at a time, at Grand Cairo, v. 168—capons clutch a freſh brood of chickens throughout the year, 169

Child, hiſtory of the child in the womb, ii. 39 to 47—children of negroes able to walk at two months old; at leaſt to move from one place to another—ſkin of children newly brought forth, is always red, and why—the ſize of a new-born infant about twenty inches, and its weight twelve pounds, 56—in cold countries continue to be ſuckled for four or five years together, 59—child's growth leſs every year, till the time of puberty, when it ſeems to ſtart up of a ſudden, 61—in ſome countries ſpeak ſooner than in others, and why, 64—children of the Italians ſpeak ſooner than thoſe of the Germans—various methods pointed out to improve the intellects of children, 64, et ſeq.—as the child increaſes in age, the inferior parts proportionably lengthen, 108—inherit the accidental deformities of their parents—inſtances of it, 238—white children frequently produced from black parents; but never black children from two whites, 240—many inſtances of the child in the womb being marked by the ſtrong affections of the mother—

how performed is not known—hard to conceive that the child, in the womb, ſhould take the print of the father's features, 248, 249

Chimborazo, a remarkable mountain in South America, i. 151

Chineſe, have neither flats nor ſharps in their muſic, ii. 166—their horſes weak, little, ill-ſhaped, and cowardly, 364—deſcription of that people, 221

Choroſan, in Perſia, bodies previouſly embalmed and buried in the ſands of that country, preſerved from corruption for a thouſand years, ii. 277

Chough, deſcription of the Corniſh chough, v. 231

Chriſtopher, St. See *Fiſh*, vi. 343

Chryſalis, or the *aurelia*, viii. 19

Chryſes, an iſland ſunk near Lemnos, i. 133

Cicero, a long poem of his in praiſe of the halcyon, of which but two lines remain, vi. 140

Circaſſians, deſcribed, ii. 230

Circe, an enchantreſs, armed her ſon with a ſpear headed with the ſpine of the trygon, vi. 256

Circulation of the blood. See *Blood*, ii. 194, 195

Civet, the ſpecies diſtinguiſhed into two kinds; Mr. Buffon calls one the civet, the other the zibet—diſtinction between the two kinds—the civet thirty inches long—both civet and zibet conſidered as varieties of the ſame animal, as former naturaliſts have done—the civet reſembles the weaſel kind, in what--differs from them, in what—the opening of the pouch, or bag, the receptacle of the civet—manner of taking the civet from the pouch—although a native of the warmeſt climates, this animal lives in temperate, and even cold countries—kinds of food it likes beſt—drinks rarely, yet makes urine often; and, upon ſuch occaſions, the male is not diſtinguiſhed from the female—numbers of theſe animals bred in Holland, and the perfume of Amſterdam reckoned the pureſt of any—the quantity greater proportionably to the quality and abundance of the food—this perfume ſo ſtrong, that it communicates to all parts of the animal's body—to its fur and ſkin—manner of chooſing the perfume—the places of conſiderable traffic in it—the animal irritated, its ſcent becomes greater; and tormented, its ſweat is ſtill ſtronger, and ſerves to adulterate or increaſe what otherwiſe obtained from it—civet a more grateful perfume than muſk—ſold in Holland for fifty ſhillings an ounce—its eyes ſhine in the night—ſees better in the dark than by day—breeds very faſt in climates where heat conduces to propagation—thought a wild fierce animal, never thoroughly familiar—lives by prey, birds, and animals it can overcome—its claws feeble and inflexible—this perfume quite diſcontinued in preſcription, iii. 389 to 394

Clavicles, or collar bones, what animals have them—Mr. Buffon ſays, none but monkeys—this is an overſight, ii. 102

Claws of the lion give a falſe idea of its power; we aſcribe to its force the effects of its arms, ii. 111—the weaſel kind neither draw in, nor extend their claws, as cats do, iii. 346—thoſe of the civet feeble and inflexible, 394

Climates, calamities in thoſe where air is condenſed by cold, i. 325—cauſe obvious and ſufficient to produce blackneſs of negroes, ii. 234—complexions of different countries darken in proportion to the heat of the region, 233, 234—next to human influence, the climate has the ſtrongeſt effects upon the nature and form of quadrupedes, 328—thoſe exceſſively hot, unfavourable to horſes, 363—in general, water fowls of no peculiar climate, vi. 104

Cloth, now made worſe than ſome years paſt, iii. 44—Flemings poſſeſſed the art of cloth-working in a ſuperior degree, 43

Clove-trees, cut down by the Dutch at Ternate to raiſe the price of the ſpice—ſoon had reaſon to repent of their avarice, i. 324, 325

Clouds, the fore-runners of a terrible hurricane, called by ſailors the bull's eye, i. 359—daſhing againſt each other, produces electrical fire—water evaporates, and riſing forms clouds—theory upon it—that of Dr. Hamilton—the author's theory of evaporation, 368 to 370—at once pour down their contents, and produce a deluge—reflecting back images of things on earth, like mirrors, 377

Clupea, or *herring*, its deſcription, vi. 308

Coaiti, a monkey of the new continent, deſcribed, iv. 236

I N D E X.

Coan, the name of a dwarf lately dead at Chelſea, ii. 254

Coaſt of Italy is bordered with rocks of marble of different kinds—thoſe of France, from Breſt to Bourdeaux, and Spain, compoſed of rocks, i. 271—of the ſea, have peculiar winds, 348, et ſeq.—deadly winds all along thoſe of the Perſian Gulph, and thoſe of India, 359

Coatimondi, extreme length of its ſnout—its deſcription—very ſubject to eat its own tail—its habits, iv. 335, 336

Cobitis, the loach, deſcription of this fiſh, vi. 308

Cobra di Capello, a kind of ſerpent, vii. 192, 201, 216

Cochineal, deſcription of this inſect as in our ſhops brought from America—difference between the domeſtic and wild cochineal—precautions uſed by thoſe who take care of theſe inſects—the propagator has a new harveſt thrice a year—various methods of killing them produce different colours as brought to us—our cochineal is only the females—uſed both for dyeing and medicine, viii. 145 to 147

Cock, of all birds the cock the oldeſt companion of man, and firſt reclaimed from the foreſt—ſpecies of cock from Japan, covered over with hair inſtead of feathers—the weſtern world had the cock from Perſia—Ariſtophanes's cock the Perſian bird—it was one of the forbidden foods among the ancient Britons—Perſia, that firſt introduced it to us, no longer knows it in its natural form—countries where it is wild—peculiarities, in a wild condition—another peculiarity in thoſe of the Indian woods, their bones, when boiled, are black as ebony—the Athenians had cock-matches as we—no animal of greater courage, when oppoſed to his own ſpecies—in China, India, the Philippine Iſlands, and over the Eaſt, cock fighting the ſport and amuſement of kings and princes—cocks in China as bold, or bolder, than ours—and of more ſtrength with leſs weight—its great courage proceeds from being the moſt ſalacious of all birds—a ſingle cock ſuffices for a dozen hens; and is the only animal whoſe ſpirits are not abated by indulgence—ſoon grows old; and in three or four years becomes unfit for purpoſes of impregnation—how long cocks live, left to themſelves, not well aſcertained—

Aldrovandus makes their age to be ten years—are injured, as Linnæus aſſerts, by elder-berries, 160 to 170—the black chiefly found in heathy mountains and piny foreſts, v. 199—cock of the wood. See *Wood-cock*.

Cockle, a bivalved ſhell-fiſh, vii. 51

Coco, the elephant eats the plant to the roots, iv. 259

Cod, from the banks of Newfoundland, purſues the whiting, which flies before it to the ſouthern ſhores of Spain, vi. 164—ſpawns in one ſeaſon, as Lewenhoeck aſſerts, above nine millions of eggs or peas, contained in a ſingle roe, 174—its deſcription, 306—fiſhery in Newfoundland, 319

Cold, promotes evaporation, although diminiſhing the force of menſtruums, i. 369—extremity of it not leſs productive of tawny complexions than that of heat, ii. 236—exceſſive, preſerves bodies from corruption, 275—ſome fiſhes rendered ſo torpid by cold, in northern rivers, as to be frozen up in the maſſes of ice, where they continue for months together, without life or ſenſation, priſoners of congelation, waiting a warmer ſun to reſtore them to life and liberty, vi. 341

Collar-bones, what animals have them, ii. 102

Colliers, eight dropped down dead by the vapour of the mines in Scotland, as if ſhot, i. 81

Colour, none refreſhes the ſight ſo well as green, i. 15—different of the waters of the ſame ſea, 274—of the ſea, not from any thing floating in it, but from different reflexions of rays of light, 292—of the blood in the arteries or veins, 332—different colours of the eye, ii. 82—whence proceeds the tawny of North-American Indians, 236—hair takes its colour from juices flowing through it, 87—that of the object contributes to form an idea of the diſtance at which it appears, 156—of all thoſe by which mankind is diverſified, ours moſt beautiful to the eye, and moſt advantageous, 232—thoſe changes the African, the Aſiatic, or the American undergo, in their colour, are but accidental deformities, which might probably be removed, 242—nothing exceeds the delicate regularity of thoſe of the zebra, 390—change of colour in the hair obtains, in ſome degree, in all quadrupedes, iii. 354—different in ſeveral parts of the fur of the ſable, 374

Comets, their number much greater than that of the planets—they roll in orbits—experience has not ſufficiently confirmed the truth of the inveſtigation about their returning periods, i. 5

Complexion, extremity of cold not leſs productive of a tawny than that of heat—not eaſy to conceive how the ſun whitens wax and linen, and darkens the human complexion—the ſun not the only cauſe of darkening it, ii. 235, 236

Comte's (Le) account of an ape he ſaw in the ſtreights of Molucca, iv. 198

Concretions, ſcarce an animal, or a part of their bodies, in which concretions are not formed—experience has found but few cures by the efficacy of theſe concretions—often prove fatal to the animal that bears them, iii. 76, 77

Condamine (La) knows a fiſh poſſeſſed of the powers of the torpedo, and every way reſembling a lamprey, vi. 263

Condoma, anomalous animal of the goat kind—its deſcription, iii. 80, 81

Condor, poſſeſſes, in a higher degree than the eagle, all the qualities that render it formidable to the feathered kind, to beaſts, and to man himſelf—is eighteen feet acroſs the wings extended, according to Acoſta, Jarcilaſſo, and Deſmarchais—the beak ſo ſtrong as to pierce the body of a cow; two of them able to devour it—they do not abſtain from man himſelf—fortunately there are few of the ſpecies—the Indians believe that they will carry off a deer, or a young calf, in their talons, as eagles would a hare or a rabbit; and that their ſight is piercing, and their air terrible; that they ſeldom frequent the foreſts, as they require a large ſpace for the diſplay of their wings—they come down to the ſea-ſhore at certain ſeaſons, when their prey fails upon land; they then feed upon dead fiſh, and ſuch nutritious ſubſtances as are thrown upon the ſhore—their countenance not ſo terrible as old writers have repreſented—thoſe who have ſeen this animal, ſay the body is as large as that of a ſheep—many inſtances of its carrying away children—circumſtantial account of this bird by P. Feuillée, the only traveller who has accurately deſcribed it—countries where it is found—in the deſerts of Pachomac, where it is chiefly, men ſeldom venture to travel—its fleſh as diſagreeable as carrion, v. 100 to 105

Conepate, an animal reſembling the ſkink in all things except ſize, iii. 381

Congar of America, reſembles the tiger in natural ferocity, though far inferior in its dimenſions, iv. 330

Congelation. See *Blood*, iv. 45

Congo, the land and ſea breezes there, i. 351—the inhabitants of that country deſire ardently to proſtitute their wives and daughters to ſtrangers, for trifling advantages, ii. 74

Conſtantinople, its cats—name given to the genetts, and why, iii. 388

Continent of America—that part under the line is cool and pleaſant, ii. 233

Coot, deſcription of that bird—reſidence and neſt—ſometimes ſwims down the current, till it reaches the ſea—dangers encountered in this voyage, vi. 35 to 38

Copel, manner of making that veſſel, i. 166

Copulation, natural inſtinct for the proper times—inſtances of it, ii. 337, 338—gnats produce young without copulation, viii. 156

Coquallin, the Braſilian ſquirrel, ſo called by Buffon, iv. 26

Coral, the common red never met with in the foſſil world, i. 46

Coral-ſerpent, deſcribed, vii. 215

Coral-plants, their various appearances—opinion of count Marſigli upon corals—Mr. Ellis proves it the work of reptiles of the polypus kind—principal experiment to this purpoſe, viii. 193 to 196

Coralines, called *fungi madrepores*, viii. 197

Cordyle, the tockay and the tejuguacu fill up the chaſm between the crocodile and the African iguana, vii. 149

Coret, a ſea-ſnail, performs the offices of male and female at the ſame time, vii. 31

Coriander uſed in dreſſing a hare in the true Roman taſte, iv. 15

Corin, name of the third variety of gazelles, by Mr. Buffon, iii. 73

Cormorant, its deſcription and food—remarkably vo-
acious, with a ſudden digeſtion—its form diſagreeable
-its voice hoarſe and croaking—all its qualities ob-
cene—no wonder Milton makes Satan perſonate this
ird—objection againſt this paſſage of Milton's Paradiſe
Loſt, vindicated—fiſhes in freſh waters, and in the
epths of the ocean—builds in cliffs of rocks, and in
rees—preys in the day-time, and by night—once uſed
n England for fiſhing, and in what manner—how edu-
ated in China, for the purpoſes of fiſhing—the beſt
ſher of all birds—ſometimes has caught the fiſh by the
ail—the fins prevent its being ſwallowed in that poſi-
ion—how it manages the fiſh in this caſe—remarked
r the quickneſs of its ſight, vi. 63 to 72

Corn, the flying ſquirrel is apt to do a great deal of
amage in the corn-fields, iv. 36

Cornaro lived an hundred years, with a conſtitution
aturally feeble, ii. 200

Cornea of a flea. See *Flea* and *Flies*, viii. 36

Cornwall, pilchards make that coaſt a place of reſort,
i. 326

Coromandel, dreadful tempeſts wholly unknown along
s coaſts, i. 348—amazing ſize of oyſters along that
oaſt, vii. 51

Corrira, or the runner, a bird of the crane kind—
s deſcription, vi. 20

Corruption, exceſſive cold preſerves bodies from it—
nd a great degree of dryneſs produced by heat—earth,
f drying and aſtringent, produces the ſame effect—
odies never corrupt at Spitſbergen, though buried for
irty years—men and animals buried in the ſands of
rabia, preſerved from corruption for ages, as if actu-
lly embalmed—bodies buried in the monaſtery of the
ordeliers at Thoulouſe, preſerved from corruption—
odies previouſly embalmed, buried in the ſands of
horoſan, in Perſia, preſerved from corruption for a
houſand years, ii. 274 to 277—amazing preſervation
om it, in a mummy lately dug up in France, 283

Coryphæna, the razor-fiſh, its deſcription, vi. 301

Cotopaxi, volcano in South America, deſcribed by
lloa, i. 99—more than three geographical miles above
he ſurface of the ſea, 151

Cotton-tree, the ſeed intoxicates parrots, as wine does man, v. 280

Cottus, the bull-head—deſcription of this fiſh, vi. 30

Couando, much leſs than the porcupine—its deſcription, iv. 114

Cougar, the red tyger, by Mr. Buffon—extremely common in South America—in what manner the Indians encounter it, iii. 244 to 247

Coulterneb, remarkable bird of the Penguin kind, See *Puffin*, vi. 97, &c.

Cows allured by muſic, ii. 169—of ruminant animals, the cow kind deſerves the firſt rank—meaneſt peaſants in Germany, Poland, and Switzerland, kill one cow at leaſt for their own table—ſalted and hung up, is preſerved as a delicacy the year round—cows want the upper fore-teeth—in no part of Europe cows grow ſo large, yield more milk, or more readily fatten, than in England—make no particular diſtinction in their herbage, indiſcriminately devouring the proper quantity—it gives back more than it takes from the ſoil—the age of the cow known by the teeth and horns—the number of its teeth—have eight cutting teeth in the lower jaw—manner of renewing them—the horns more ſurely determine this animal's age, and how—while this animal lives, the horns lengthen—wants in udder what it has in neck—the larger the dew lap, the ſmaller the quantity of its milk—the kind to be found in every part of the world—large in proportion to the richneſs of the paſture—Africa remarkable for the largeſt and ſmalleſt cattle of this kind; as alſo India, Poland, and Switzerland—among the Eluth Tartars, the cow ſo large, that a tall man only can reach the tip of its ſhoulder—of all quadrupedes, the cow moſt liable to alteration from its paſture—the breed of the Iſle of Man, and moſt parts of Scotland, much leſs than in England; alſo differently ſhaped—the breed improved by foreign mixture, adapted to ſupply the imperfections of our own—ſuch as purely Britiſh, far inferior in ſize to thoſe of the continent, iii. 8 to 13—the cow, the urus, and the biſon, animals of the ſame kind—difference in ſize not ſo remarkable as thoſe in its form, hair, and horns—many conſidered as a dif-

erent kind, and names given them as a diſtinct ſpecies,
hen in reality all the ſame—only two varieties of the
ind really diſtinct, the cow and the buffalo—they bear
n antipathy to each other—ſcarce a part of the world
here the cow kind is not found—variety of the horns
—thoſe in Iceland are without horns—the Barbary
ow, or zebu—of all animals, the cow moſt exten-
ively propagated—an inhabitant of the frozen fields of
celand, and the burning deſarts of Lybia—other ani-
als preſerve their nature or their form with inflexible
erſeverance—the cows ſuit themſelves to the appetites
nd conveniencies of mankind—no animal has a greater
riety of kinds, none more humble and pliant—the
ow and biſon breed among each other—the cow does
ot breed with the buffalo—no animals more diſtinct,
r have ſtronger antipathies to each other—the cow
es nine months with young—the grunting, or Sibe-
an cow, and the little African, or zebu, are different
aces of the biſon—animals of the cow kind, by natu-
liſts extended to eight or ten ſorts, reduced to two—
animal of the cow kind, by no naturaliſt deſcribed—
e deſcription of it, iii. 15 to 34—the Greeks com-
ured the eyes of a beautiful woman to thoſe of a cow,
2—it eats two hundred and ſeventy-ſix plants, and re-
ects two hundred and eighteen, 176

Cow-bezoar, a factitious ſort, iii. 76

Crab, a ruminating fiſh, iii. 5—ſurpriſing manner in
hich the monkies draw crabs from the water, iv. 228
—found in freſh and ſalt water, and upon land—de-
ription—its inteſtines have many convolutions, vi.
61, 362—land-crabs of various kinds—ſome healthful
nd nouriſhing—others poiſonous or malignant to a
eat degree—places where found, 362

Crab (violet) of the Caribbee iſlands, deſcribed—their
ood—their nippers, the principal inſtrument for ſeizing
nd cutting their food—catch ſuch hold, that the limb
s loſt ſooner than the graſp—thus it gets off, leaving
s claw faſtened upon the enemy—the claw performs its
uty, and keeps a minute faſtened upon the finger,
hile the crab makes off—it loſes no great matter by a
g or an arm, as they grow again, the animal becomes
erfect as before—fatiguing and amazing march from

the mountains to the ſea-ſhore, to depoſit the ſpawn
from which, ſoon after, millions of little crabs are ſee
ſlowly travelling up the mountains—wait the benefit
ſea water for their delivery—change their ſhells—ha
under their ſtomachs four white ſtones, which grad
ally decreaſe as the ſhell hardens, and when come
perfection, are not to be found—ſeaſon, and manner
which they are caught—in Jamaica they are in gre
plenty, and conſidered as one of the greateſt delicaci
—many of this kind found poiſonous, vi. 363 to 370—
ſoldier-crab, ſeen every year deſcending from the mou
tains to the ſea-ſhore, to depoſit its ſpawn, and to pro
vide itſelf with a new ſhell—conteſt between them f
ſome well-looking, favourite ſhell, for which they a
rivals—ſtrike with their claws—beat each other, till th
weakeſt is obliged to yield, and give up the object
diſpute—when taken, ſends forth a feeble cry, ende
vouring to ſeize the enemy with its nippers—not muc
eſteemed for its fleſh, vi. 370 to 373

Crane, bred familiarly in our marſhes formerly—n
now, and why, v. 33—general characteriſtics and ha
bits of birds of the crane kind—their food and fleſh—
deſcription of the crane—Geſner ſays, its feathers,
his time, were ſet in gold, and worn as ornaments
caps—deſcription of this bird from ancient writers, wh
have mixed imagination with hiſtory — whence ha
ariſen the fables of ſupporting their aged parents, an
fighting with pigmies—the crane a ſocial bird, and ſe
dom ſeen alone—uſual method of flying or ſitting,
flocks of fifty or ſixty together—while part feed, th
reſt keep guard—ſubſiſts moſtly upon vegetables—a
known in every country of Europe, except our own—
are birds of paſſage—ſeaſons of their migrations, duri
which they do incredible damage, chiefly in the night—
were formerly known, and held in great eſtimation her
for the delicacy of their fleſh—there was a penalty upo
deſtroying their eggs—Plutarch ſays, cranes were blin
ed, kept in coops, and fattened for the tables of th
great in Rome—at preſent, they are conſidered all ov
Europe as wretched eating—qualities of its fleſh—the
note the loudeſt of all other birds; and often heard
the clouds, when the bird itſelf is unſeen—amazin

heights to which they aſcend when they fly—though unſeen themſelves, they have diſtinct viſion of every object below—extraordinary length and contorſion of its windpipe—uſe made of their clangorous ſound—they riſe but heavily, are ſhy birds, and ſeldom let the fowler approach them—their depredations uſually in the darkeſt nights; when they enter a field of corn, and trample it down, as if croſſed over by a regiment of men—corn their favourite food; ſcarce any other comes amiſs to them—Redi's experiments to this purpoſe—a little falcon purſues, and often diſables it—method uſed on ſuch occaſions by thoſe fond of hawking—barbarous cuſtom of breeding up cranes to be thus baited—eaſily tamed—Albertus Magnus ſays, it has a particular affection for man—the female diſtinguiſhed from the male, by not being bald behind—never lays above two eggs at a time—the young are ſoon fit to fly; and unfledged, they run with ſuch ſwiftneſs, that a man cannot eaſily overtake them—Aldrovandus aſſures us one was kept tame for above forty years—the vulgar bear the crane a compaſſionate regard—prejudices in its favour—a heinous offence in ſome countries to kill a crane—diſtinctions between the crane and the ſtork, 366 to 382

Crane, the *Balearic*, from the coaſt of Africa, and the Cape de Verd iſlands—its deſcription—habits—has been deſcribed by the name of ſea-peacock—real Balearic Crane of Pliny—foreign birds of the crane kind deſcribed; the jabiru, the jabiru-guacu, the anhima—the buffoon bird, or Numidian crane, deſcribed, v. 386 to 391—place where the crane kind ſeem to have formed their general rendezvous—the flamingo the moſt remarkable of all the kind, the talleſt, bulkieſt, and moſt beautiful—deſcribed, vi. 9, 10, 11—ſmall birds of the crane kind, vi. 21

Cræſus, (king of Lydia) ſeated on his throne, with all the barbarous pomp of Eaſtern ſplendor, aſking Solon if he had ever beheld any thing ſo fine? was anſwered, that after the beautiful plumage of the pheaſant, he could be aſtoniſhed at no other finery, v. 184

Cricetus, the *German rat*, by Mr. Buffon called the hamſter—its deſcription—is the greateſt peſt in the countries where found, and every method made uſe of to deſtroy it—its hole a curious object for contemplation; ſhews a ſkill ſuperior to the reſt of the rat kind—deſcription of it—their ſtorehouſes—contain two buſhels of good grain in each apartment—means of finding out their retreats—produce young twice or thrice a year, and bring five or ſix at a time—their devaſtations produce a famine—they deſtroy each other—their fur very valuable, iv. 81 to 84

Gricket, a ruminating inſect, or ſeemingly ſo, iii. 6—difference from the graſshopper—their voice—food—never drink—ſound of drums and trumpets make them forſake their ſituation, vii. 349 to 352

Cricket (mole) deſcribed—thought to be amphibious—the number of their eggs—moſt deteſted by gardeners—its devaſtations—precautions of the female againſt the black beetle—their care and aſſiduity in the preſervation of their young, vii. 352 to 354

Croches, in the head of a ſtag, iii. 114

Crocodile, extraordinary combat between this animal and the tiger, iii. 247, 248—the ichneumon diſcovers and deſtroys its eggs—kills its young, and ſometimes entering the mouth of the crocodile, when ſleeping on the ſhore, effectually deſtroys it, 377—the eggs it lays in the ſand at a time, often amount to three or four hundred, 380—the places where found, together with their dimenſions—deſcription—ſeveral examples of taking a man out of a canoe from his companions, notwithſtanding all oppoſition and aſſiſtance—terrible even upon land—its depredations—combats between the crocodile and the tiger—in what manner it ſeizes its prey—how a negroe ventures to attack this animal in its own element—manner of taking it in Siam—often managed like a horſe; a curb put into its mouth, and the rider directs it as he likes—manner of taking it along the rivers of Africa—pools of water where bred as we breed carp in our ponds—in Egypt, and other long-peopled countries, this animal ſolitary and fearful—in the river San Domingo, they are moſt inoffenſive; children play with them, and ride about on their backs; beat them without receiving the ſmalleſt injury—probable opinion, its muſky ſubſtance amaſſed in glands under the legs and arms—its fleſh—the eggs to the ſavages moſt delicate morſels—all breed near freſh waters—precautions in laying their eggs—the female having introduced her young to their natural element, ſhe and the male become their moſt formidable enemies—the open-bellied crocodile, thought viviparous—has a falſe belly like the oppoſſum, for the young to creep out and in, as danger or neceſſity requires—their age—produced to fight at the amphitheatre at Rome, vii. 118 to 138

Croppers, a kind of pigeons, v. 293

Croſsbill, bird of the ſparrow kind, v. 315, 317

Croſt fox, animal between the dog and fox, iii. 341.—See *Iſatis*.

Crown, in the head of a ſtag, iii. 114

Crows fetch and carry with the docility of a ſpaniel, v. 222—the *carrion-crow* reſembles the raven in appetites, laying, and manner of bringing up its young—the *Royſton crow*, 230

Cruelty, teaching the arts of cruelty, equivalent to committing them, v. 164

Cruſtaceous, animals of the lobſter kind, vi. 352

Cub, the fox is ſo called during the firſt year, iii. 328—born blind, like thoſe of the dog, 331

Cuckoo, fables invented of this bird, now ſufficiently refuted—where it reſides in winter, or how provides for its ſupply during that ſeaſon, ſtill undiſcovered—this bird ſomewhat leſs than a pigeon, ſhaped like a magpie, and of a greyiſh colour—is diſtinguiſhed from all other by its round prominent noſtrils—diſcovers itſelf in our country early in the ſpring, by its well-known call—its note heard earlier or later, as the ſeaſon is more or leſs forward, and the weather inviting—from the chearful voice of this bird, the farmer inſtructed in the real advancement of the year—hiſtory and nature of this bird ſtill in great obſcurity—its call an invitation to courtſhip, uſed only by the male, generally perched upon a dead tree, or bare bough, repeating his ſong, which he loſes when the genial ſeaſon is over—his note pleaſant, though uniform—the female makes no neſt—repairs to the neſt of ſome other bird, generally the water-wag-tail or hedge-ſparrow, and, after devouring the eggs of the owner, lays hers in their place—uſually lays but one—this the little fooliſh bird hatches with great aſſiduity, and when excluded, fondly thinks the great ill-looking changeling her own—to ſupply this voracious creature, the credulous nurſe toils with unwearied labour, not ſenſible ſhe is feeding up an enemy to her race—the ſtomach of this bird is enormous, and reaches from the breaſt-bone to the vent—its food—naturally weak and fearful—the ſmaller birds form a train of purſuers; the wry-neck, in particular, the moſt active in the chace—ſuppoſed, in winter, to lie hid in hollow trees, or to paſs into warmer climates—ſtory of a cuckoo found in a willow log, in winter—probable opinion concerning its reſidence in winter—Briſſon makes not leſs than twenty-eight ſorts of this bird; and talks of one of Braſil, as making a horrible noiſe in the foreſts, v. 263 to 269—follows a very different trade from what its nurſe endeavoured to teach it; and, according to Pliny, in time deſtroys its inſtructor, vi. 124

Cuckow-ſpit, or *Froth-worm*, its deſcription, vii. 358

Cud, the hare, the rabbit, and the ſquirrel, placed by Pierius among thoſe that chew the cud—how far true, is not determined, iv. 3

Cuguacu apara, name in Braſil for the roe-buck, iii. 140

Cummin ſeed, formerly uſed in dreſſing a hare in true Roman taſte, iv. 15

Cur, the *Cur-fox*, iii. 332

Curiſchaff, a lake where the ſturgeon is found in greateſt numbers, vi. 273

Curlew, a ſmall bird of the crane kind—its dimenſions—places where found—manner of procuring its food—its habits—its neſt, and number of eggs—a bird of paſſage, vi. 22 to 27—ſeaſon of courtſhip, 30

Currants, indigeſtible to man when ſwallowed whole, v. 74

Currents of rivers well explained by the Italians, i. 200—ſide current—back current, 205—ſometimes the current at bottom ſwifter than at top, and when—double current, 206—found to run in all directions—manner in which mariners judge of the ſetting and rapidity of the current—currents are generally found moſt violent under the equator—a paſſage with the current gone in two days, with difficulty performed in ſix weeks againſt it—currents do not extend above twenty leagues from the coaſt—the currents at Sumatra extremely rapid, run from ſouth to north—alſo ſtrong currents between Madagaſcar and the Cape of Good Hope; but the moſt remarkable are thoſe continually flowing into the Mediterranean ſea—current runs one way at top, and the ebb another way at bottom, 260 to 264

Current of air, driven through a contracted ſpace, grows more violent and irreſiſtible, i. 355

Cuſco, Garcilaſſo de la Vega aſſerts the air is ſo dry and ſo cold there, that fleſh dries like wood, without corrupting, ii. 274

Cuſtom, the form of the face ſeems rather the reſult of cuſtom, ii. 238

Cuttle fiſh, its deſcription—contrivance with which it is furniſhed by nature, when under a difficulty of eſcaping, viii. 177

Cybotus, a lofty mountain ſwallowed by an earthquake, i. 162

Cynocephalus, the *Magot* of Buffon, the laſt of the ape kind—its deſcription—is a native of Africa and the Eaſt, iv. 207

Cyprinus, or the carp, vi. 308

Czar of Ruſſia. See *Peter* of Ruſſia.

D.

Dam, in the rapacious kinds, leads her young forth for months together; it is not ſo with thoſe of the hare kind, iv. 6

Dampier, has added more to natural hiſtory than half the philoſophers before him, vi. 391

Damps, of various natures in mines—the fulminating ſort, i. 79, 80

Dance, hares taught to dance to muſic, iv. 9

Dancer, a dog of the mongrel kind, iii. 286

Dane, the talleſt dog bred in England, iii. 286, 290

Danube, has ſeven openings into the Euxine ſea, i. 132—proceeds from the Alps, 142—its courſe—the Turks and Chriſtians have fleets of men of war upon it, 209—it receives thirty leſſer rivers, 217—the huſo, or iſinglaſs fiſh, caught in great quantities in this river, vi. 278

Dara, its inhabitants uſe oſtriches as horſes, v. 62

Darien, an iſthmus—has a particular hog called warree—deſcribed by Waſer, iii. 196

Darkneſs, ſurpriſing how far the eye accommodates itſelf to it, ii. 160—remarkable inſtance of it, in a gentleman, a major under Charles the Firſt, 161

Daubenton, gives a complete hiſtory of a dwarf, ii. 254, et ſeq.

Deaf men, often found to ſee the force of thoſe reaſonings, which they could not hear, underſtanding every word as it was ſpoken, ii. 90—one born deaf, muſt neceſſarily be dumb—inſtances of two young men, who, born deaf, were reſtored to hearing—a perſon born deaf, by time and pains taught to write, read, ſpeak, and, by the motion of the lips, to underſtand what is ſaid—inſtances of it, 174 to 177

Deafneſs, one of the moſt common diſorders in old age, ii. 172—way to know this defect, either internal or external, 173

Death, a young man, born deaf and dumb, knew nothing of death, and never thought of it till the age of twenty-four, when he began to ſpeak of a ſudden, ii. 176—a ſpectre which frights us at a diſtance, but diſappears when we come to approach it—uncertainty of the ſigns of death, 206 to 210

Deer, annually ſhedding horns, and their permanence in the ſheep, draws a diſtinct line between their kinds, iii. 36—the little Guinea deer, the leaſt of all clovenfooted quadrupedes, and moſt beautiful—its deſcription, 82—the male in Guinea has horns, but the female is without—they abound in Java and Ceylon, 83—all of the deer kind want the gall bladder, 94—a downy ſubſtance like velvet upon the ſkin covering the ſkull of a deer, when the old horn is fallen off, 96—their horns grow differently from thoſe of ſheep or cows—they are furrowed along the ſides, and why, 97—the bran deer, or the brown deer, called by the ancients tragelaphus, found in the foreſts of Germany, 122—the new continent of America produces animals of the deer kind, in ſufficient plenty, 123

Deer (fallow) no animals more nearly allied than the ſtag and fallow deer, yet they never herd nor engender together, nor form a mixed breed—each form diſtinct families, and retain an unalterable averſion—the fallow deer rarely wild in the foreſts; are in general bred in parks, and their fleſh is preferred to that of any other animal—a herd of them divides into two parties, and engage each other with great ardour and obſtinacy—both deſirous of gaining a favourite ſpot of the park for paſture, and of driving the vanquiſhed into the more diſagreeable parts—manner of their combats—are eaſily tamed—and browze cloſer than the ſtag—they ſeek the female at their ſecond year—their ſtrength, cunning, and courage inferior to thoſe of the ſtag—we have in England two varieties of the fallow deer; one brought from Bengal, the other from Norway—fleſh of the French fallow deer, has not the fatneſs nor the flavour of that fed upon Engliſh paſture—Spaniſh and Virginian fallow deer—deer without horns, their deſcription, iii. 125 to 131

Deer (rein) the moſt extraordinary, and moſt uſeful—native of the icey regions of the North—it anſwers the purpoſes of a horſe—attempts made to accuſtom it to a more ſouthern climate, in a few months it declines and dies—anſwers the purpoſes of a cow in giving milk; and of the ſheep in furniſhing warm cloathing to the people of Lapland and Greenland—deſcription of the rein deer—its rutting time, and that of ſhedding its horns—difference between this deer and the ſtag—it is not known to the natives of Siberia—Americans call it caribou—herdſmen of Lapland known to poſſeſs a thouſand rein deer in a ſingle herd—it ſubſiſts upon moſs—and makes the riches of the people of Lapland—gnats and gadflies very formidable to this deer in Lapland—female brings forth in May—its milk thinner than that of the cow; ſweeter and more nouriſhing, iii. 149 to 158—is of two kinds in Lapland—it draws ſledges—can go about thirty miles without halting, and without dangerous effort—generally caſtrated by the Laplanders—one male left to ſix females—begin to breed when two years old—go with young eight months, and bring two at a time—fondneſs of the dam remarkable—live but fifteen or ſixteen years—manner in which the Laplanders kill them—ſcarce any part of this animal not converted to peculiar uſes—the Laplanders find their neceſſities ſupplied from the rein deer alone—in what manner—diſeaſes of this animal—the blood of the rein deer reſerved in ſmall caſks, for ſauce with the marrow in ſpring—the horns converted into glue—the ſinews make the ſtrongeſt ſewing thread—the tongues a great delicacy—the inteſtines, waſhed like our tripe, in high eſteem among the Laplanders—bears make depredations upon the rein deer—glutton its moſt dangerous and ſucceſsful perſecutor—only method of eſcape from this creature, 162 to 170—in what manner the rein deer is killed by it, 398, 399—the wolf never attacks a rein deer that is haltered in Lapland, and why, 321

Deformity, children often inherit even the accidental deformities of their parents—inſtances of it, ii. 238—accidental deformities become natural—by aſſiduity continued and encreaſed, through ſucceſſive generations, 239—all thoſe changes the African, the Aſiatic, or the American undergo, in their colour, are accidental deformities, probably to be removed, 242

Demoſeille, name given by the French to the Numidian bird, v. 390

Denmark. See *Henry IV*.

Depona, a large ſerpent, native of Mexico, vii. 227

Derbent, paſtures in theſe plains excellent for rearing horſes, ii. 361

Derbyſhire, deſcription of the neſt of an eagle found in the peak of Derbyſhire, v. 93

Derham, by a microſcope, diſcovered in the eye of a mole, the parts known in other animals, iv. 92

Deſman, one of the three diſtinctions of the muſk rat—a native of Lapland, iv. 78

Devil, the Swediſh Laplanders conſult him, ii. 214

Devil (ſea) or fiſhing frog, deſcribed, vi. 281

Dew, compenſates the want of ſhowers in Egypt, i. 358—hares quench their thirſt with it, iv. 7

Dewlap. See *Zebra*, ii. 398. See *Cow*, iii. 14

Diableret, a mountain in France ſuddenly fallen down—its ruins covered an extent of a league ſquare, i. 157

Dictionaries of Arts and Sciences, a fault that has infected moſt of them, ii. 308

Diet, of a thin ſparing kind, remarkable among quadrupedes, as well as the human ſpecies, to produce hair, iii. 355

Digeſter, an inſtrument—meat and bones put into it, diſſolved into a jelly in ſix or eight minutes, i. 308

Digeſtion, theſe organs in birds are in a manner reverſed, v. 16—is not perfect in all birds that live upon mice, lizards, or ſuch like food, 142—performed by ſome unknown principle in the ſtomach, acting in a manner different from all kinds of artificial maceration—this animal power lodged in the maw of fiſhes, vi. 161, 162

Diſeaſes, of the rein deer—the manner in which the Laplanders cure them, iii. 168, 169

Diſorders, infectious, propagated by the effluvia from diſeaſed bodies, i. 327—moſt of thoſe incident to mankind, ſays Bacon, ariſe from the changes of the atmoſphere, vi. 171—fiſhes have their diſorders, 341

Diver, (the great northern) a bird of the ſmaller tribe of the penguin kind—the grey ſpeckled diver, vi. 96—the ſcarlet-throated diver, 97

Divers, known to deſcend from twenty to thirty fathom, i. 288—of all thoſe who have brought information from the bottom of the deep, Nicolas Peſce the moſt celebrated — account of his performances by Kircher, 293 to 297—ſome known to continue three quarters of an hour under water without breathing—they uſually die conſumptive—manner of fiſhing for pearls, vii. 58, 59

Dodo, its deſcription—among birds, as the ſloth among quadrupedes, an unreſiſting animal, equally incapable of flight or defence—native of the Iſle of France—the Dutch firſt diſcovered and called it the nauſeous bird—travellers deem its fleſh good and wholeſome—it is eaſily taken—three or four dodos enough to dine a hundred men—whether the dodo be the ſame bird with that deſcribed under the name of the bird of Nazareth, remains uncertain, v. 76 to 78

Doe, the female of the deer kind, iii. 128

Dogs, always running with their noſes to the ground, ſuppoſed of old the firſt that felt infection, i. 319—no other animal of the carnivorous kind will make a volun-

tary attack, but with the odds on their ſide, ii. 319—the Arabian horſes out-run them, 347—in the dog kind the chief power lies in the under jaw, iii. 200—in Syria, remarkable for the fine gloſſy length and ſoftneſs of their hair, 212—in tropical climates, loſe the delicacy of their ſcent, and why—the lion, tiger, panther, and ounce, all natural enemies to the dog, 262—dog kind not ſo ſolitary as thoſe of the cat, 270—their proper prey are animals unfitted for climbing, 271—they can live for ſome time upon fruits and vegetables, 272—deſcription of the dog—knows a beggar by his cloaths, by his voice, or his geſtures, and forbids his approach, 273—the dog moſt ſuſceptible of change in its form, 278—all dogs are of one kind, which the original of all the reſt, which the ſavage dog, whence ſuch a variety of deſcendants, is no eaſy matter to determine—the ſhepherd's the primitive animal of his kind—thoſe wild in America and Congo, as thoſe of Siberia, Lapland, Iceland, of the Cape of Good Hope, of Madagaſcar, Calicut, and Malabar, reſemble the ſhepherd's dog—thoſe in Guinea, at the ſecond or third generation, forget to bark—dogs of Albany, of Greece, of Denmark, and of Ireland, larger and ſtronger than any other—ſhepherd's dog, tranſported into temperate climates, and among people entirely civilized, from influence of climate and food alone, become a matin, a maſtiff, or a hound—*Turkiſh dog*—*great Daniſh dog*—*great wolf dog*, or *Iriſh wolf dog*, 280, 292—the *little Daniſh dog*—their variety now in England much greater than in the time of queen Elizabeth—Dr. Caius divides the whole race into three kinds—the generous; the farm kind; the mongrel, 280 to 286—three ſhepherd's dogs reckoned a match for a bear, and four for a lion—three of them overcame a lion in the time of king James the Firſt—the famous poet, lord Surry, the firſt who taught dogs to ſet—the *pug dog*—the Engliſh *bull dog*—the *lion dog*, originally from Malta—its deſcription—the *Moloſſian dogs* of the ancients, according to Mr. Buffon—*Epirotic dogs*, mentioned by Pliny—*Indian dogs*, mentioned by Ælian—his deſcription of a combat between a dog and a lion—the braveſt of the kind—the nobler kind of dogs, of which ſuch beautiful ancient
deſcriptions,

deſcriptions, now utterly unknown, 289 to 296—puppies eyes not open till ten or twelve days old—dog's teeth amount to forty-two—this animal capable of reproducing at the age of twelve months—goes nine weeks with young, and lives about twelve years—other particulars concerning dogs—many kinds of birds the dogs will not touch—dogs and vultures living wild about Grand Cairo in Egypt, continue together in an amicable manner, and are known to bring up their young in the ſame neſt—dogs bear hunger for a long time—a bitch forgotten in a country-houſe, lived forty days, without any other ſuſtenance than the wool of a quilt ſhe had torn in pieces, 300 to 305—the wild, hunt in packs—unknown, ſuch as he was before the protection of man—ſome, from a domeſtic ſtate, have turned ſavage, and partaken of the diſpoſition of the wolf, and attack the moſt formidable animals of the foreſt, 276—are eaſily tamed, and quickly become familiar and ſubmiſſive, 277—experiments to prove the wolf and the fox not of the ſame nature with the dog, but of a ſpecies perfectly diſtinct—animals in this country bred between a dog and a fox, 298—a dog ſet at liberty, in his ſavage fury flew upon every animal, fowls, dogs, and men, 300—the dog and wolf ſo much alike internally, that anatomiſts can ſcarce perceive the difference—a young dog ſhudders at the ſight of a wolf—dogs and wolves ſo different in their diſpoſitions, that no animals have a more perfect antipathy, 309—by inſtinct, without education, dogs take care of flocks and herds, 310—ſhew no appetite to enjoy their victory when the wolf is killed, but leave him where he falls, 318—Cateſby aſſerts the wolf was the only dog uſed by the Americans, before the Europeans came among them, and that they have ſince procreated together; thus proving the dog and the wolf of the ſame ſpecies, 322—unſurmountable antipathy between the dog and the jackall—they never part without an engagement, 338—famiſhed dogs more hairy than thoſe whoſe food has been more plentiful, 355—all kinds purſue the hare by inſtinct, and follow it more eagerly than other animals, iv. 5—few dogs dare to encounter the otter, 153—ſome purpoſely trained for diſcovering the retreat of the otter, 155

Dog-butchers all over China, and ſhambles for ſelling their fleſh—wherever a dog-butcher appears, all the dogs of the place are in full cry after him—along the coaſts of Guinea, their fleſh is eſteemed a delicacy by the negroes; they give a cow for a dog, iii. 297

Dolphin caught in the Red Sea, known by a ring to be the ſame taken before in the Mediterranean, i. 263—allured by muſic, ii. 168—not eaſy to aſſign a cauſe why the ancients have invented ſo many fables on the ſubject—their boundings in the water have taught mariners to prepare for a ſtorm—old painters and ſculptors have drawn them wrong; the poets have adopted the error—Pliny has aſſerted, they inſtantly die when taken out of the water; Rondelet aſſures us he has ſeen a dolphin carried alive from Montpellier to Lyons—their motions the gambols of pleaſure, or the agitations of terror, not well known—in fairer weather they herd together, and purſue ſhoals of various fiſh with impetuoſity, vi. 218 to 220

Dolphin, is alſo the name of the ophidium, or the gilthead, vi. 299

Don, or *Tanais*, a river—its courſe, i. 209—the ſturgeon is caught in great quantities at the mouth of that river, vi. 273

Dorado, ſuppoſed a ruminating fiſh, iii. 5—a fiſh of the ſpinous kind, the moſt voracious—its deſcription—the flying-fiſh is chiefly ſought by it—warfare carried on between them, vi. 334 to 336

Doree, deſcription of this fiſh, vi. 303

Dormouſe, the mercury of the thermometer plunged into the body of a living dormouſe, never roſe beyond its pitch in air, and ſometimes ſunk above a degree, iv. 45—the greater ſort Mr. Buffon calls the *loir*; the middle ſize he calls the *lerot*; and the leſs he denominates the *muſcardin*—their deſcriptions—agree in being ſtupified like the marmout during winter—their neſts and proviſions—they bring forth three or four young at a time, but once a year, in the ſpring, 76 to 78

Dorr-beetle, or *May-bug*, viii. 130. See *Beetle*.

Dottrel, ſmall bird of the crane kind, vi. 22

Doves, the *ring-dove*, v. 293—the *turtle-dove*, 290—the *ſtock-dove*, 285, 291. See *Pigeon*.

Douc, a monkey of the ancient continent, ſo called in Cochinchina, where it is a native—its deſcription—forms part of the chain by which the monkies of one continent are linked with thoſe of the other, iv. 235

Draco volans, a flying ball of fire, i. 379

Drag, name given by the huntſmen to the tail of the fox, iii. 328

Dragons, the whole race dwindled down to the flying lizard, vii. 156

Dragon-fly, or the libella, deſcribed, vii. 316

Dragonet, deſcription of this fiſh, vi. 300

Dreſs, the firſt impreſſion generally made, ariſes from dreſs, ii. 99

Drill of Purchas, an ape of the kind of the ouran-outang, iv. 189

Dromedary, a ſort of camel, iv. 302 to 311

Drone, a ruminating inſect, or ſeemingly ſo, iii. 6

Drones, the ſecond ſort of bees, ſuppoſed to be the males, viii. 66—their cells, 72—the working bees kill the drones in the worm ſtate, in the cell, and eject them from the hive, among the general carnage, 86

Drugs, in the tropical climates loſe their virtue, and become verminous, i. 314

Drum, among the Swediſh Laplanders every family has one for conſulting the devil, ii. 214—hares taught to beat the drum, iv. 9

Dryneſs, a great degree of it produced by heat, preſerves from corruption, ii. 275

Duck, when ducks are caught, the men keep a piece of turf burning near their mouths, and breathe upon it, leſt the fowl ſmelling them, ſhould eſcape, v. 11—of the numerous tribes of the duck kind, no more than five breed here, 34—Plutarch aſſures us, Cato kept his family in health, feeding them with duck, whenever they threatened to be out of order, vi. 109—its eggs often laid under a hen—ſeems a heedleſs, inattentive mother—of the tame duck, ten different ſorts; and of the wild, Briſſon reckons above twenty—the moſt obvious diſtinction between the wild and tame ducks—difference between wild ducks among each other—ſea, and pon ducks—names of the moſt common birds of the duc kind, among ourſelves, and of the moſt noted of th foreign tribe—their habits, neſts, and number of eggs— are, in general, birds of paſſage—their fleſh—the ducks flying in the air, often lured down from their heights b the loud voice of the mallard from below—what par of the lake they generally chooſe—what can employ them all day, not eaſy to gueſs—manner of making an managing a decoy to take them—the American wood duck, 124 to 135—general ſeaſon for catching them i decoys, from the end of October till February—takin them earlier prohibited by an act of George the Second imposing a penalty of five ſhillings for every bird de- ſtroyed at any other ſeaſon—amazing quantity of duck ſent to ſupply the markets of London—manner of tak- ing them frequently practiſed in China, 136

Dumb. See *Deaf.*

Dung, ſome animals void it when purſued—this ariſe rather from fear than a deſire of defence, iii. 32

Dunlin, a ſmall bird of the crane kind, vi. 22

Dutch, ſolicitous about the preſervation of the ſtork in every part of their republic, v. 383

Dwarf, in England, as late as the times of kin James the Firſt, the court was furniſhed with one; an he was called Little Jeffery—Peter of Ruſſia celebrate a marriage of dwarfs, ii. 251—they ſeem to have fa- culties reſembling thoſe of children—hiſtory of a dwar accurately related by Mr. Daubenton, ii. 254 to 258

Dwina, a river—its courſe, and ſource, i. 210

E.

Eagle kind, the flap of an eagle's wing known to la a man dead in an inſtant, v. 9—it flies at the buſtard or the pheaſant, 81—diſtinctive marks from the other kinds of carnivorous birds—the golden eagle is the largeſt and the nobleſt of all thoſe birds deſigned by the name of eagle—its deſcription—conſidered among birds, as the lion among quadrupedes—ſtrong ſimilitude to each other—great patience, and much art, required to tame an eagle—though taken young, and brought under by long aſſiduity, yet it is a dangerous domeſtic, and often turns its force againſt its maſter—ſometimes has an attachment for its feeder; it is then ſerviceable, and will provide for his pleaſures and ſupport—flies the higheſt of all birds, and from thence has by the ancients been called the bird of heaven—it has alſo the quickeſt eye; but its ſenſe of ſmelling is far inferior to that of the vulture—it never purſues but in ſight—finds difficulty in riſing when down—carries away geeſe, cranes, hares, lambs, and kids, and often deſtroys fawns and calves, to drink their blood, and carries a part of their fleſh to its retreats—infants, when left unattended, have been deſtroyed by theſe rapacious creatures—the eagle is peculiarly formidable when bringing up its young—a poor man got a comfortable ſubſiſtence for his family, during a ſummer of famine, out of an eagle's neſt, by robbing the eaglets of food—eagles killed a peaſant who had robbed their neſts—there is a law in the Orkney iſlands, which entitles any perſon that kills an eagle to a hen out of every houſe in the pariſh in which the plunderer is killed—the neſt of the eagle is uſually built in the moſt inacceſſible cliff of the rock—deſcription of one found in the Peak of Derbyſhire—it hatches its eggs for thirty days—very rare to find three eaglets in the ſame neſt; and it is aſſerted, that the mother kills the moſt feeble, or the moſt voracious—it is believed they live above an hundred years, and that they die, not of old age, but from the beaks turning inward upon the under jaw, and preventing their taking any food—an eagle endured hunger for twenty-one days, without any ſuſtenance whatever—they are firſt white, then inclining to yellow, and at laſt light brown—age, hunger, captivity, and diſeaſes, make them whiter—thoſe kept tame are fed with every kind of fleſh, freſh or corrupting; and upon a deficiency of that, bread, or any other proviſion, will ſuffice—it is dangerous approaching them, if not quite tame; and they ſometimes ſend forth a loud, piercing, lamentable cry, which renders them ſtill more formidable—they drink but ſeldom, and perhaps, when at liberty, not at all—the bald eagle an inhabitant of North Carolina—breeds in that country all the year round—manner in which the eggs are hatched—characteriſtics and habitudes of this animal—its neſt is large enough to fill th body of a cart, and commonly full of bones half eaten and putrid fleſh, the ſtench of which is intolerable, 8 to 96

Eagle, the *ſea-eagle* called *aquila piombina* by the Italians—they often lay three or four eggs, of a leſs ſiz than thoſe of a hen, of a white elliptical form—diſtinctive marks of the *golden eagle*, of the *common eagle*, o the *bald eagle*, of the *white eagle*, of the *kough-foote eagle*, of the *white-tailed eagle*, of the *erne*, of the *blac eagle*, of the *ſea-eagle*, of the *oſprey*, of the *jean le blanc* of the *Braſil eagle*, of the *Oroonoko eagle*, of the *crowne African eagle*, of the *eagle* of *Pondicherry*, v. 95 to 99

Ears, diſtinguiſhing features in quadrupedes—ſerve i them as principal marks of the paſſions—ſmalleſt ear in men ſaid to be moſt beautiful—the largeſt the beſt for hearing—ſome ſavage nations bore their ears, and draw that part down, till the tip of the ear reſts upon the ſhoulder, ii. 95—the richeſt jewels in an Æthiop's ear, a proverb, 98—undulations, which ſtrike the ear, ſuppoſed but one continued ſound, by their quick ſucceſſions, though in reality they make many, 163—perſons hear differently with one ear from the other—theſe have what muſicians call a bad ear; and, as hearing falſe, alſo ſing falſe—ſuch perſons alſo deceived as to the ſide whence the ſound comes, 173—from what cauſe the ſmall ears of the Tartars and Chineſe, 239—thoſe of the hare moveable, and capable of direction to every quarter, iv. 4—are remarkably good, 9—birds have not the external ear ſtanding out from the head—probably the feathers encompaſſing ear-holes, ſupply the defect of the exterior ear, v. 11

Earth, its globe a million of times leſs than the ſun, i. 3—placed at a happy middle diſtance from the centre, in our ſolar ſyſtem—leſs diſtant from the ſun than Saturn, Jupiter, and Mars, and leſs parched up than Venus and Mercury, ſituated too near the violence of its power—the earth, like a chariot-wheel, has a compound motion—its rotundity proved—is rather flatted at the poles, and its form reſembles that of a turnep, 8 to 10—conſidered as one ſcene of extenſive deſolation, 21

—ſuppoſed by Buffon a globe of glaſs—by Whiſton, a ſphere of heated iron—by Kircher, one dreadful volcano—by Burnet, a great maſs of water—compoſed of different layers or beds, lying horizontally one over the other, like the leaves of a book, 51, 52

Earth (garden) or mould-earth, a kind of mother, never found an enemy to man, i. 52—black earth formed by decayed leaves and branches in Burgundy, 55—drying and aſtringent earth preſerves bodies from corruption, ii. 276—all ſuch earths as ferment with vinegar, are a compoſition of ſhells, decayed, and crumbled down to one uniform maſs, vii. 13

Earthquakes, frequent through the whole region where a volcano is ſituated, i. 88—various kinds of them diſtinguiſhed by philoſophers, and by Mr. Buffon—air the only active operator in them—ſeveral opinions upon the cauſe of them—activity of internal heat alone ſufficient to account for every appearance attending earthquakes—twelve cities in Aſia Minor ſwallowed up in one night—extraordinary earthquake related by Pliny—account of that in the year 1693, extending to a circumference of two thouſand ſix hundred leagues—minute deſcription of that in Jamaica in 1692—account of the dreadful ſhock in Calabria in 1638—concomitant circumſtances attending earthquakes, 104 to 122

Earth-worm of America often a yard in length, and thick as a walking cane, ii. 6—multiplied by being cut in pieces, 23—its deſcription, viii. 167. See *Worm.*

Earwig, its habits—reproaches groundleſs about this animal—its food--general characteriſtics of the kind—lives in its winged ſtate a few days—dies to all appearance conſumptive, vii. 355 to 358

Eaſt Indies, favourable months of embarking for them, i. 346

Echeneis, the ſucking-fiſh—its deſcription, vi. 306

Echini, or urchins, a multivalve ſhell-fiſh, vii. 61. See *Urchins.*

Echo, no art can make an echo, ii. 172

Edgar, king of England, the firſt who attempted to rid this kingdom of wolves, and in what manner, iii. 319

Edward I. iſſued his mandate to Peter Corbet to ſuperintend, and aſſiſt in the deſtruction of wolves, iii. 320

Edward III. made it felony to ſteal a hawk, v. 118

Edward IV. his act concerning ſwans, vi. 117

Eel, deſcribed, vi. 305

Effluvia from diſeaſed bodies propagate diſorders called infectious, i. 327

Egg, all birds, moſt fiſhes, and many of the inſect tribes, brought forth from eggs—warmth of the ſun, or of a ſtove, efficacious in bringing the animal in the egg to perfection—its deſcription—hiſtory of the chicken in the egg, to its complete formation, ii. 26 to 35—quadrupedes brought forth from the egg, above two hundred at a time, 339—the ichneumon diſcovers and deſtroys the eggs of the crocodile, iii. 377—the crocodile lays in the ſand at a time three or four hundred, 380—ſome eggs only addled by incubation, v. 24—ſuch birds as undiſturbed lay but two or three eggs, when their eggs are ſtolen, lay ten or twelve—a common hen, moderately fed, lays above an hundred, from the beginning of ſpring to the latter end of autumn, 30—ſome of the oſtrich weigh above fifteen pounds, 56—Galen thought the eggs of hens and pheaſants good to be eaten—thoſe of geeſe and oſtriches are the worſt of all, 63—and thoſe hatched in the hot ſand, where laid, 66—taking the eggs of a hawk, puniſhed with impriſonment, and a fine, at the king's pleaſure, in the reign of Edward III. 118—inhabitants of Norway prepare from the eggs of the porpeſſe a kind of caviar, or delicate ſauce, and good when eaten with bread, vi. 223—manner in which the eggs of fiſhes are impregnated, wholly unknown, 332—doubts whether fiſh come from the egg completely formed, 330—thoſe of the turtle hatched by the ſun, 397

Eggs (ſea) name given in our cabinets to a multivalve ſhell-fiſh, called echini, or urchins, by naturaliſts, vii. 61—thoſe of the ſea-urchin a great delicacy, 63—opening the body of a queen-bee, there appeared in it five thouſand eggs, viii. 76

Eglantine, found in a well dug at Marly, i. 57

Egypt, has ſouth winds ſo hot during ſummer, that reſpiration is almoſt ſtopped by them—they are charged with ſuch quantities of ſand, that they darken the air, as with a cloud—it rains very ſeldom in that country, but the want of ſhowers is compenſated by the copiouſneſs of their dews, i. 357, 358—the catacombs, ii. 277—a mummy, not long ſince dug up in France, ſhews the art of embalming more completely underſtood in the weſtern world, than in Egypt itſelf, 283—the Tingitanians and Egyptians have now the ſame of rearing the fineſt horſes, both for ſize and beauty, 356—the ichneumon uſed in this kingdom, for the ſame purpoſes that cats are in Europe, iii. 376

Egyptians. See *Embalming*. See *Ibis.*

Eider-duck, vi. 126—remarkable for the warmth of its neſt, 129

Elaboratory, bowels of ruminating animals conſidered as an elaboratory, with veſſels in it, iii. 3—the chemical apparatus for hatching chickens, v. 168

Elaſticity of the air, i. 299, 303

Elder-berries, hurtfnl to cocks, v. 170

Elephant, not afraid ſingly to make oppoſition to the lion, iii. 225—not leſs remarkable for its ſize than its docility—all hiſtorians concur in giving it the character of the moſt ſagacious animal next to man—its height from ſeven to fifteen feet—impoſſible to give an idea of this animal's figure by deſcription; aſſiſted by the art of the engraver, it will but confuſedly repreſent the original—general obſervations about its conformation—of all quadrupedes, the elephant the ſtrongeſt, and largeſt; yet neither fierce, nor formidable—in its native deſarts ſeldom alone, being a ſocial, friendly creature—the oldeſt conducts the band; the next in ſeniority brings up the rear—order maintained in dangerous marches—never ſo far aſunder as to be incapable of reciprocal aſſiſtance—their invaſions the more diſagreeable, there being no means of repelling them; ſince an attempt to moleſt a drove would certainly be fatal—manner of going againſt him who offers the inſult—do no perſonal injury when ſuffered to feed uninterrupted—moleſted by man, they ſeek all occaſions to be revenged—where they like beſt to live in their natural ſtate—cannot live far from water; and always diſturb it before they drink—oſten fill their trunk with water, to cool it, or by

way of play to ſpurt it out like a fountain—equall
diſtreſſed by the extremes of heat and cold—ſwim fro
the continent into iſlands ſome leagues diſtant—fre
quently migrate from one country to another, and wh
—their food of the vegetable kind, loathing all ſort o
animal diet—one finding a ſpot of good paſture, invite
the reſt to partake of it—precautions by negroes an
Indians againſt them—they often break through thei
fence, deſtroy the harveſt, overturn their habitation
and then retreat in order, as they made the irruption-
—looks with attention and friendſhip at its maſter-
its ears wipe its eyes, and cover them againſt the du
and flies—it likes muſic, learns to beat time, move i
meaſure, and join its voice to the ſound of the drum an
trumpet—is pleaſed with the odours that delight man-
the orange flower particularly grateful to its taſte an
ſmell—picks up flowers, and is pleaſed with the ſcen
—ſeeks the moſt odoriferous plants for food—prefer
the coco, the banana, the palm, and the ſago tree to a
others—eats plants to the roots—their ſenſe of touch
ing moſt delicate—deſcription of its trunk—ſerving a
the purpoſes of a hand—breathes, drinks, and ſmell
through the trunk—takes a pin from the ground, un
ties knots of a rope, unlocks a door, and writes with
pen, iv. 252 to 260—an object too large for the trunk t
graſp, is ſucked up by its breath, lifted and ſuſtained-
the trunk its organ of ſmelling, of touching, of ſuction
of ornament, and defence—its neck ſo ſhort, that i
muſt turn about to diſcover what is behind it—how th
hunters eſcape its reſentment—a deſcription of its leg
—while young, it bends the legs; but when old o
ſickly, it wants human aſſiſtance, and chuſes to ſlee
ſtanding—a deſcription of its feet, and of its tuſks-
theſe, with age, become ſo heavy, that it is obliged t
reſt them in holes in the walls of its ſtall—they are tw
—their amazing ſize—they proceed from the upper jaw
not from the frontal bones—and are not horns, as ſom
have ſuppoſed—nor ever ſhed in a domeſtic ſtate—Ælian
ſaw an elephant write Latin characters on a board, hi
keeper only ſhewing him the figure of each letter—ex-
traordinary manner of eating—is not a ruminating ani-
mal—its ſtomach and inteſtines reſemble thoſe of

horſe—opinion that the young elephant ſucks with its trunk, not with its mouth, referred to future diſcoverers—the ſkin not covered with hair, a few briſtles in the ſcars and wrinkles of the body, and thinly ſcattered over the ſkin, the hide reſembles the bark of an old tree, more than the ſkin of an animal—is ſubject to that diſorder known by the name of elephantiaſis, or Arabian leproſy—in what manner the Indians endeavour to prevent it—the flies torment this animal inceſſantly—what arts it tries to keep them off—in a ſtate of nature, it rarely quits the river, and often ſtands in water up to the belly, 261 to 266—from time immemorial employed for the purpoſes of labour, of war, to encreaſe the grandeur of eaſtern princes, or to extend their dominions---is a native of Africa and Aſia---ſtill retains its natural liberty in Africa—-during the ſplendour of the Carthaginian empire, they were uſed in the wars---no elephants found on this ſide Mount Atlas—-places where they are in great numbers---the greateſt elephants found in Aſia --their price encreaſes in proportion to their ſize—the largeſt kept for princes—their colour—that appropriated for the monarch's own riding, kept in a palace, attended by nobles, and almoſt adored by the people—opinions concerning the white elephant—the eaſtern princes maintain as many elephants as they are able, and place great confidence on their aſſiſtance in an engagement—they never breed in a ſtate of ſervitude, and the generative powers fail when it comes under the dominion of man—duration of pregnancy in the female ſtill a ſecret—what Ariſtotle and others ſay concerning this and their young is doubtful—method of taking them wild in the woods—negroes of Africa, who hunt this animal for its fleſh, take it in pit-falls—its attachment to the perſon that attends it—it comprehends ſeveral of the ſigns made to it, diſtinguiſhes the tone of command from that of anger or approbation, and acts accordingly—executing orders with prudence, eagerly, yet without precipitation—is taught to kneel down, to receive its rider, uſually mounted upon its neck—careſſes thoſe it knows, ſalutes ſuch as ordered to diſtinguiſh, and helps to take up part of its load—takes a pleaſure in the finery of its trappings—draws chariots, cannon, or ſhipping, with ſtrength and perſeverance; and ſatisfaction, provided it be not corrected without a cauſe, and that its maſter be pleaſed with its exertions —in what manner the conductor guides it—frequently takes ſuch an affection to its keeper, as to obey no other—has been known to die of grief for killing its conductor in a fit of madneſs—ſurpriſing inſtance of moderation in its fury—a word ſufficient to put it into motion, 267 to 275—a century or two ago, the Indian generals made great dependence upon the number and the expertneſs of their elephants—of late they are little uſed, except for drawing cannon, and tranſporting proviſions —ſtill they are uſed in war in Siam, in Cochin-China, in Tonquin, and Pegu—in what manner armed and led to battle—effects of its fury in the field—thoſe placed upon its back in a ſquare tower, combat as from an eminence, and fling down their weapons with double force—nothing more dreadful, or more irreſiſtible, than ſuch moving machines, to men unacquainted with the modern arts of war—Romans quickly learned the art of opening their ranks to admit the elephant, and ſeparating it from aſſiſtance, compelled its conductors to calm the animal's fury, and to ſubmit—ſometimes, inſtead of obeying, turned upon thoſe it was employed to aſſiſt—one elephant is known to conſume as much as forty men in a day—they are now chiefly employed in carrying or drawing burthens throughout the peninſula of India—it can, with eaſe, draw more than ſix horſes can remove—it carries upon its back three or four thouſand weight; and upon its tuſks it can ſupport near a thouſand—when puſhed, it moves as ſwiftly as a horſe at full gallop—it travels fifty or ſixty miles a day; and, hard preſſed, almoſt double that quantity—heard trotting on at a great diſtance—its track is deeply impreſſed on the ground, and from fifteen to eighteen inches in diameter—uſed in India as executioners, and with what dexterity they perform the horrid taſk—ſometimes they impale the criminal on their enormous tuſks—two ſurpriſing inſtances how ſenſible it is of neglect—the keeper deſpiſing its endeavours in launching a ſhip, the animal redoubled its efforts, fractured its ſkull, and died upon the ſpot—revenge one of them took upon a taylor who pricked its trunk with a needle at Deli—is mindful of benefits—inſtance of it—at the Cape of Good Hope they are hunted for the ſake of their teeth—in what manner—account of an unhappy huntſman, 276 to 281—teeth of the elephant found in a foſſil ſtate—two great grinding teeth, and part of the tuſh of an elephant, diſcovered at the depth of forty-two yards, in a lead mine in Flintſhire—tuſks of the elephants that come from Africa ſeldom exceed two hundred and fifty pounds—it is defeated by the rhinoceros, 282 to 287

Elephantiaſis, or the Arabian leproſy, a diſeaſe to which man and the elephant are equally ſubject—in what manner the Indians endeavour to prevent it, iv. 265

Elizabeth, (queen) her injunction upon faſting, ii. 131—in her times, the whole kingdom could not ſupply two thouſand horſes to form the cavalry, 370

Ellis, his principal experiment upon coraline ſubſtances, viii. 196

Elk, its ſize equal to that of the elephant—is an animal rather of the buck than the ſtag kind—known in America by the name of mooſe-deer—is ſometimes taken in the German and Ruſſian foreſts; but extremely common in North America—its horns fortuitiouſly dug up in many parts of Ireland, meaſuring ten feet nine inches from tip to tip—a ſmall one, the ſize of a horſe, and the horns little larger than thoſe of a common ſtag—Jocelin and Dudley deſcribe this animal about eleven feet high; others extend their accounts to twelve and fourteen feet—never diſturbs any other animal, when ſupplied itſelf—a female of this kind ſhewn at Paris in the year 1742—its deſcription—they gave it thirty pounds of bread every day, beſides hay; and it drank eight buckets of water, iii. 140 to 143

Elk, (American) of two kinds, the grey and the black; deſcribed—they prefer cold countries, feeding upon graſs in ſummer, and the bark of trees in winter—time and manner of hunting them—its fleſh very well taſted, and very nouriſhing—its hide ſtrong, and ſo thick, as to turn a muſket-ball; yet is ſoft and pliable—this animal troubled with the epilepſy—is but very indifferently and confuſedly deſcribed by travellers—their various deſcriptions, iii. 144 to 149—in what manner killed by the glutton, 398

Elops, or *Sea-ſerpent*, its deſcription, vi. 304

Ely, an iſland, the country round it was once a moſt delightful ſpot, i. 279—producing grapes that afforded excellent wine—the ſea breaking in, overwhelmed the whole country, 280

Emanuel, (king of Portugal) to try the ſtrength of the elephant and rhinoceros, made them fight, and the elephant was defeated, iv. 287

Embalming, the Egyptians carried this art to perfection, ii. 267—copious detail of this art as practiſed among them—in Geneſis, Joſeph ſeeing his father expire, ordered his phyſicians to embalm the body—various methods of embalming—the art ſtill among the Guanches, ancient inhabitants of the iſland of Teneriffe, when the Spainards conquered it—particulars of their method of embalming—the Peruvians alſo underſtood this art, according to Father Acoſta, ii. 268 to 273—a mummy lately dug up in France, ſhews the art more completely underſtood in the weſtern than the eaſtern world, 283

Embroidery, done in India with porcupine quills, as belts, baſkets, and neceſſary pieces of furniture, iv. 112

Embryo, its firſt rudiments—in a month an inch long—the male developes ſooner than the female—progreſs and encreaſe of it, ii. 39 to 47, and 61—in the human, the under jaw much advanced before the upper, 91—brain, and ſpinal marrow, firſt ſeen begun, 146—the bones as ſoft as the fleſh, 193

Emigration, cauſes of emigrations of birds, v. 32—in what manner performed, 35

Emu, an inhabitant of the new continent, called alſo the American oſtrich—deſcription, and places where found—runs ſo ſwiftly, the dogs loſe the purſuit—one ſurrounded by hunters, the dogs avoided its rage—peculiar in hatching its young—the young at firſt familiarly follow any perſon—as they grow older, become cunning and diſtruſtful—their fleſh good to be eaten—they live entirely upon graſs, v. 64 to 67

Encoubert of Buffon, the tatou of Ray, a ſhelly quadrupede, iv. 132

England claims dominion over the ſeas encompaſſing Great Britain and Ireland, i. 232—loſing its ſuperio-ity upon the ocean, its ſafety becomes precarious, 233 late as king James I. the court ſtill furniſhed with a warf, a giant, and a jeſter, ii. 251—the aſs entirely ft under queen Elizabeth, 385—not infeſted with olves, iii. 319—the viper the only venomous animal here, vii. 203

Enquiries moſt intricate generally moſt uſeleſs, ii. 21

Entry, a term in the chace of the ſtag, iii. 114

Ephemera, various kinds of this inſect—its deſcrip-ion—colours of their aurelias—their tranſmutations—laces where found in abundance—ſhort duration—their mpregnation, vii. 361 to 368

Epicure, the greateſt has the moſt depraved taſte, ii. 84

Epiphanius (St.) lived an hundred and fifteen years, i. 132

Equator, deſcription of the regions under it, i. 13

Ermine, its deſcription—alike in figure to the weaſel, its fur the moſt valuable of any—the time in which it is alled the ſtoat—manner of moulting its hair—one ate honey, and died ſhortly after—proof of a diſtinct ſpecies from the pole-cat or the martin—one of theſe fed with eggs and fleſh, let them putreſy before it touched either —in Siberia, taken in traps baited with fleſh; and in Norway, ſhot with blunt arrows, or taken in traps—ſometimes found white in Great Britain, and is then called white weaſel—its fur among us of no value, iii. 353 to 358—preys upon the leming, iv. 89

Erne, kind of eagle—its diſtinctive marks, v. 97

Eruption of a volcano, remarkable, in 1537, i. 89—of Veſuvius, in which Pliny the naturaliſt was ſuffocated, and the city of Herculaneum was overwhelmed—another, of the ſame mountain, in 1707, deſcribed—of Cotopaxi, in 1743, deſcribed by Ulloa—matter thus exploded lies a little below the bed of the mountains, in Mr. Buffon's ſyſtem—but ſupplied from the deeper regions of the earth, i. 91 to 103

Eſculapian ſerpent of Italy—its excrement a pleaſing perfume, vii. 184—a domeſtic creature, 223

Eſox, or the pike, deſcription of this fiſh, vi. 307

Eſquimaux Indians deſcribed, ii. 213, et ſeq.

Evaporation, cold diminiſhing the force of menſtruums, promotes evaporation—theory for the formation of the clouds—prevented by moiſt weather—dry froſt aſſiſts evaporation, i. 369, to 371

Evils, thouſands of natural evils permitted to exiſt in the world, and why, i. 20

Eunuchs of two kinds, the white and the black—made in Italy to improve the voice—inſtance, in our country, of a very fine woman married to an eunuch, ii. 73, 74

Euphæmia, a city in Calabria, ſunk by an earthquake, i. 119

Euphrates, a river, its ſources, i. 211, 212—receives eleven rivers, 217

Eurites, a city ſwallowed by an earthquake, i. 162

Europeans reſemble our common parent more than any of the reſt of his children—argument which ſuffices to prove it, ii. 239, 240

Euſtachian tube, a paſſage from the ear into the mouth—its uſe, ii. 173

Ewe. See *Buck-goat*, iii. 35

Excrements of ſome ſerpents kept as the moſt pleaſing perfume at Calicut and Cranganon, in Eaſt-India, vii. 184

Executioner, elephants in India uſed as ſuch—impale the criminals on their tuſks, iv. 279

Exerciſe, manual, hares taught to go through it, iv. 9

Exhalations, mineral, raiſed by ſubterranean heat, i. 338—when copious, every where fatal, i. 326

Exocetas, the flying fiſh, its deſcription, vi. 308

Experience, repeated, ſhews how ſeldom pains are ſuffered, or pleaſures enjoyed, to the utmoſt, ii. 208

Experiment, by Mr. Belcher, upon the circulation of the blood through the bones, ii. 194—made by approaching a looking-glaſs to the mouth, to diſcover breathing, very uncertain, 209—of a carp placed under an air-pump, vi. 165—the famous experiment of Malpighi, concerning the ſtigmata of the caterpillar, viii. 14

Extraneous, or foſſil ſhells, found in the bowels of the earth, vii. 15

Eyes, opened by the infant the moment of its birth, ii. 54—particularly in them the paſſions are painted, 81—ſmall, and nearly cloſed, are liked in China and Japan, 77—different colours of the eye, whence they ariſe, 82—eyes of oxen are brown; thoſe of ſheep of a water-colour; of goats are grey; and thoſe of moſt white animals are red, 83—diſtance between the eyes leſs in man than in any other animal, 84—in what circumſtances women with child are ſaid to be all mouth and eyes—the lower eye-lids, in women with child, drawn downwards, 104—of all parts the animal has double, the eyes produced ſooneſt—privation of feeling and ſight would miſrepreſent the ſituation and number of all things around us—two contribute to diſtinct and extenſive viſion—both eyes ſee round the object, and give it that heightened relief which no painting does attain to—in either is there a point which has no viſion, the defect is corrected by having the organ double—eaſy experiment to be convinced of it—objects at a diſtance are rarely equal in both eyes—the beſt eye ſees objects largeſt—infants having their eyes leſs, muſt ſee objects ſmaller in proportion—when we look at an object extremely brilliant, viſion becomes indiſtinct, and why—how far the eye can accommodate itſelf to darkneſs—remarkable inſtance of it in a major under king Charles I. 145 to 161—whence have ariſen the ſmall eyes of the Tartars and Chineſe, 239—eaſtern poets compare the eyes of their miſtreſſes to thoſe of the gazelle—the Greeks reſemble the eyes of a beautiful woman to thoſe of a cow, iii. 72—of all animals, natives of this climate, none have an eye ſo beautiful as the ſtag, 105—that of the wolf opens ſlantingly upwards, in the ſame direction with the noſe, 307—of the fox, placed obliquely, like thoſe of the wolf, 324—of the civet, ſhine in the night, 394—thoſe of the hare placed backwards, to ſee behind it as it runs, and theſe are never wholly cloſed, iv. 4—peculiar advantages of ſmallneſs of the eye in the mole, 94—deſcription of the eyes of birds of the owl kind, v. 137—in the eyes of all animals, a complete proviſion to ſhut out too much light, or to admit a ſufficiency, by contraction and dilatation of the pupil, 138—thoſe of the great Greenland whale not larger than thoſe of an ox,

vi. 192—of the ſnail on the points of its largeſt horns, vii. 20—peculiarities in the eyes of the cameleon, 155—eyes of the butterfly have not all the ſame form—the outward coat has a luſtre diſplaying the various colours of the rainbow—examined a little cloſely, it will be found to have the appearance of a multiplying glaſs, viii. 35, 36—the beetle in its worm ſtate has no eyes, 132

Eye-brows joining in the middle conſidered a peculiar grace by Tibullus, and by the Perſians, ii. 76—Le Brun's directions, regarding the paſſions, place the principal expreſſion in them, 84—ſuch as have them moſt at command are the beſt actors, 85—the Talapoins of Siam ſhave the eye-brows of the children committed to their care, 96

Eye-laſhes, men and apes only have them upon the upper and lower lids—all other animals want them on the lower lid, ii. 85

Eye-lids, in birds and amphibious quadrupedes, the lower eye-lid alone has motion—fiſhes and inſects have no eye-lids, ii. 85

F.

Face, its form the reſult of cuſtom, ii. 238. See *Beauty*, ii. 265

Falcon-gentle, a kind of hawk—it purſues the gazelles, iii. 84, 85—many people admire its fleſh, and dreſs it for eating, ſays Belonius, v. 85—method of training up this bird—falconry, much diſuſed among us, was a principal amuſement of our anceſtors—the falcon-gentle and the peregrine much leſs than the gyr-falcon, which exceeds all others in largeneſs—deſcription of the gyr-falcon—a courageous and fierce bird, not fearing the eagle—it chiefly flies at the ſtork, the heron, and the crane—is chiefly found in the northern regions, but loſes neither ſtrength nor courage, when brought into the milder climates—the falcon-gentle moults in March, and ſooner—the peregrine does not moult till Auguſt—the common falcon is of ſuch ſpirit, that, like a conqueror in a country, he keeps all in awe and ſubjection to his prowеſs—young falcons, though depreſſed by captivity, will, when brought out, fly at barnacles and wild geeſe—the falcon's purſuit of the heron, kite, or oodlark, the moſt delightful ſport—names of the falons in uſe here, and in other countries—among the Welch, the king's falconer the fourth officer of the ate; was forbid to take more than three draughts of eer from his horn, leſt he ſhould neglect his duty, v. 18 to 127

Falconers catch the kite for the purpoſes of training he falcon, and how, v. 146

Fallopius, the two tubular veſſels perceived by him, i. 17

Famine ſupported by carnivorous animals for ſeveral weeks together, ii. 323

Fat of the chamois, its medicinal virtue—fat of animals found efficacious in ſome diſorders, iii. 69—of he manati, expoſed to the ſun, has a fine ſmell and aſte, and exceeds the fat of any ſea animal—the heat of the ſun will not ſpoil it, nor make it rancid—ſeveral other qualities of this fat, iv. 185, 186

Father-laſher, deſcription of this fiſh, vi. 302

Fawn, name of the buck and the doe the firſt year, iii. 128

Feathers of birds deſcribed, v. 6—of the oſtrich almoſt as ſoft as down, 50—different uſes made of gooſe-feathers, vi. 124, 125

Feather-beds utterly unknown in countries bordering on the Levant, and all Aſia—ancients did not uſe feather-beds—Pliny ſpeaks of bolſters of feathers for their heads—feathers make a conſiderable article of commerce—different qualities—beſt method of curing them —old feathers more valuable than new, vi. 122, 123

Fecundity of the rabbit greater than of the hare, iv. 16

Feeling, deprived of feeling, our eyes would miſrepreſent the ſituation and the number of all things around us, ii. 147—blind men have this ſenſe finer than others, and why—the groſſeſt and moſt uſeful of the ſenſes—no total deprivation of it but with life—thoſe parts moſt exerciſed in it, acquire the greateſt accuracy—the fingers, by habit, greater in the art than others, not from their having more nerves, 185—fiſhes having no organs for feeling, muſt be the moſt ſtupid of all animals—feeling, the guardian, the judge, and the examiner of all the ſenſes, is never found to deceive, 186

Ferret has eyes of a red colour, ii. 83—not ſound a preſent here but in the domeſtic ſtate—its deſcription—a native of the torrid zone—naturally ſuch an enemy o the rabbit, that a young ferret, although unacquainte with the kind, will fiercely attack and bite even a dea one—uſe of ferrets in warrens, to enter the holes muzzled, and drive the rabbits into the nets at the mouth—to bring the ferret from his hole, ſtraw and other ſubſtances burnt at the mouth—the female leſs than th male, whom ſhe ſeeks with great ardour, and ofte dies without being admitted—they ſleep continually, and the inſtant they awake ſeem eager for food—ar uſually fed with bread and milk—breed twice a year—ſome devour their young as ſoon as brought forth, an then become fit for the male again—the litter uſuall from five to ſix young; and theſe conſiſt of more females than males—its ſcent fœtid—has attacked an killed children in the cradle—is eaſily irritated, and then ſmells more offenſively—its bite difficult of cure—has eight grinding teeth—to the ferret kind may b added an animal called by Mr. Buffon the vanſire, iii. 359 to 362—comes originally from Africa, iv. 22

Fever, opinion that the lion is in a continual fever, iii. 224

Fewmet, name for the excrement of the ſtag, iii. 113

Fibres, muſcular, compoſe the ſtomachs of inſects, iii. 6

Fieldfare, bird of the ſparrow kind, v. 314, 317, 323

Fielding. See *Smile.*

Figure, little known exactly of the proportion of th human figure, ii. 106—different opinions concerning it, 107—whence proceed the variations in the human figure, 239—the oldeſt meaſure of the human figure in the monument of Cheops, in the firſt pyramid of Egypt, 264

Finder, a dog of the generous kind, iii. 286

Fins, different purpoſes they anſwer in fiſhes, vi. 151 to 154—thoſe of the whale—their uſe, 190, 191, 196

Fin-fiſh, vi. 189—its food, 198

Fingers, by habit, and not from a greater number of nerves, become exacter in the art of feeling than any other part, even where ſenſation is more delicate and fine, ii. 185

Fire, perpetual, in the kingdom of Perſia, i. 86—advantages ariſing from the ſubterranean fires, 124, 125—put out by the ſun ſhining upon it, and why, 333, 334—fleeting balls of fire, 377—great globe of fire ſeen at Bononia in Italy, not leſs than a mile long, and half a mile broad, 382—lighted to preſerve herds and flocks from animals of the cat kind, iii. 222

Fireflare, Pliny, Ælian, and Oppian, ſupply the weapon of this fiſh with a venom affecting even the inanimate creation—reaſons to doubt of it, vi. 255, 256, 257

Fiſhes, petrified, found in the mountains of Caſtravan, i. 45—fiſh in abundance found in a new-formed iſland—thoſe who eat of them died ſhortly after, 126—cannot live in water whence the air is exhauſted, 316—ſhowers of fiſhes raiſed in the air by tempeſts, 389—moſt of them produced from the egg, ii. 26—have no eye-lids at all, 85—nor any neck, 102—are allured by muſic, 168—having no organs for feeling, muſt be ſtupid, 186—ruminating ſort, iii. 5—opinion, that all fiſh are naturally of the ſalt element, and have mounted up into freſh water by accidental migration—ſome ſwim up rivers to depoſit their ſpawn; of which the ſize is enormous, and the ſhoals endleſs—all keep to the ſea, and would expire in freſh water—the number to which names are given, and of the figure of which ſomething is known, according to Linnæus, are above four hundred—their purſuits, migrations, ſocieties, antipathies, pleaſures, times of geſtation, and manner of bringing forth, are all hidden in the turbulent element that protects them—the hiſtory of fiſhes can have little in it entertaining; for, inſtead of ſtudying their nature, pains have been taken to encreaſe their catalogues—that ſhape granted to moſt fiſhes, is imitated in ſuch veſſels as are deſigned to ſail with the greateſt ſwiftneſs—any large fiſh overtakes a ſhip in full ſail, with great eaſe—the chief inſtruments in the motion of a fiſh are the fins—in ſome they are more numerous than in others—it is not always the fiſh with the greateſt number of fins that have the ſwifteſt motion—how the fins aſſiſt the fiſh in riſing or ſinking, in turning, or leaping out of the water—all this explained by the experiment of a carp put into a large veſſel—all fiſhes covered with a ſlimy, glutinous matter, that defends their bodies from the immediate contact of the ſurrounding fluid—they fall behind terreſtrial animals in their ſenſations—their ſenſe of touching and ſmelling—their ſenſe of taſting—hearing is found ſtill more imperfect, if found at all—Mr. Gouan's experiment to this purpoſe—from it is learned they are as deaf as mute—their ſenſe of ſeeing—their brain—their rapacity inſatiable—when out of the water, and almoſt expiring, they greedily ſwallow the bait by which they are allured to deſtruction—the maw placed next the mouth; and though poſſeſſed of no ſenſible heat, is endued with a faculty of digeſtion, contrary to the ſyſtem, that the heat of the ſtomach is alone ſufficient for digeſtion—though for ever prowling, can ſuffer want of food very long—inſtances of it—life of a fiſh but one ſcene of hoſtility, violence, and evaſion—the cauſes of annual migrations—all ſtand in need of air for ſupport—thoſe of the whale kind come to the ſurface of the ſea every two or three minutes, to breathe freſh air—experiment of a carp in a large vaſe of water, placed under an air-pump—general method of explaining reſpiration in fiſhes, vi. 149 to 166—the deſcription and uſes of their air-bladder—full play of the gills prevented, or the bony covers kept from moving, the animal would fall into convulſions, and die—ſome fiſhes have no air-bladder—can live but a few minutes without air—nothing more difficult to account for, than the manner of their getting this ſupply—no part of the account of the uſe of the air-bladder well ſupported—Bacon's obſervations upon their growth and age—two methods for determining the age of fiſhes, more ingenious than certain—a carp found to be a hundred years old—the diſcovery confirmed by authors—longevity of theſe animals, nothing compared to their fecundity—ſome multiply by millions—ſome bring forth their young alive, and ſome produce eggs—the former rather the leaſt fruitful—the viviparous blenny brings forth two or three hundred at a time, all alive, and playing together round the parent, 167 to 173—different ſeaſons for depoſiting ſpawn, 176—ſome fiſhes have the tenderneſs of birds or quadrupedes for their young, 177—their copulation as yet a doubt, 175—the fleſh of fiſhes—queſtion to the learned concerning the fleſh of fiſhes, 179—cetaceous fiſhes, 181—cartilaginous fiſhes, 227—ſucking-fiſh ſticks to the ſhark—called the ſhark's pilot, and why, 242—all fiſh more delicate about a baited hook, than their ordinary food, 248—beſt bait for all is freſh herring cut in pieces of a proper ſize, 252—experience ſhews, the larger fiſh take a ſmall one upon the hook, ſooner than any other bait, 253—more than thoſe of the ray kind poſſeſſed of the numbing quality—Condamine informs us of a fiſh with the powers of the torpedo, and reſembling a lamprey, 263—lamprey of the Engliſh Severn the moſt delicate fiſh whatever, 266—*ſun-fiſh*, deſcribed, 280, 281—*lump-fiſh*, 283—*pipe-fiſh*, 284—*galley-fiſh*, 289, 290—ſpinous fiſhes, 293—Mr. Gouan's ſyſtem of ſpinous fiſhes, 296 to 310—uſe of it—all fiſh of the ſame kind have the ſame number of bones—the ſmall, lean, and with many fins, the moſt bony—vulgar expreſſion, that fiſhes at ſome ſeaſons are more bony than at others, ſcarce deſerves contradiction—none imbibe the ſea-ſaltneſs with their food, or in reſpiration—whence then do ſome fiſhes live there, and quickly expire in freſh water—ſome tribes live only in the ſea; others only in freſh water; ſome a part of the ſeaſon in one, and a part in the other, as the ſalmon, the ſhad, the ſmelt, and the flounder—ſome fiſh, as the eel, deſcend the freſh-water ſtream, to bring forth their young in the ſea—in what ſeaſon—long voyages undertaken by ſome tribes that conſtantly reſide in the ocean, and may be called fiſh of paſſage—ſtated returns and regular progreſs of theſe fiſh of paſſage the moſt extraordinary circumſtances in the hiſtory of nature—names of ſeveral migrating fiſhes—of all ſuch, the herring and pilchard take the moſt adventurous voyages—places where found in abundance, 312 to 321—in the iſlands of the Indian Ocean, an over quantity, in ſhoals, on the ſwamps, dried up by the ſun—the putrefaction renders the country unhealthful—amazing propagation along our coaſts and rivers, not proportionate to the quantities among the iſlands of the Indian Ocean—places where the ſpawn is depoſited—doubts whether moſt fiſh come from the egg completely formed—manner in which the eggs of fiſh are impregnated, wholly unknown—growth of fiſhes—inſtance in the growth of the mackarel—all live upon each other in ſome ſtate of their exiſtence—of thoſe in the ocean, of the ſpinous kinds, the dorado the moſt voracious—flying-fiſh chiefly ſought by the dorado—their warfare—opinion that all fiſhes are natives of the ſea, founded upon their ſuperior fecundity of breeding twenty to one—certainly freſh-water fiſhes abate of their courage and rapacity—greedineſs of the ſea-fiſh to devour the bait prodigious, compared with the manner it is taken in freſh water—difference of baits with which they are caught—ſome fiſhes rendered ſo torpid in the northern rivers, as to be frozen up in the maſſes of ice, and continue there ſeveral months, ſeemingly without life or ſenſation, waiting the approach of a warmer ſun, to reſtore them to life and liberty—each ſpecies of fiſh infeſted with worms of different kinds—moſt vivacious animals—often live upon ſubſtances poiſonous to the more perfect claſſes of animated nature—numbers of fiſhes making poiſonous wounds, ſcarcely to be doubted—ſome fiſhes being poiſonous is notorious, the cauſe inſcrutable—Dr. Grainger, after reſiding many years at St. Chriſtopher's, affirms, that of fiſh caught at one end of the iſland, ſome were good and wholeſome, while others of the ſame kind, taken at a different end, were dangerous, and commonly fatal—the Philoſophical Tranſactions give an account of poiſonous qualities of fiſh, at New Providence—all kinds, at different times, alike dangerous; the ſame ſpecies this day ſerving as nouriſhment, the next found fatal—ſpeculations and conjectures to which theſe poiſonous qualities have given riſe, 329 to 343

File-fiſh, moſt wonderful of the ſhelly tribe, vii. 65. See *Pholades*.

Fiſhery of pearls, ſeveral—chiefly carried on in the Perſian Gulph, vii. 56—the people deſtined for the pearl fiſheries—they die conſumptive, 58—in what manner they fiſh for pearls, 59

Fiſhing-frog, from its deformity called *ſea-devil*—conceit that this fiſh uſes its two long beards, or filaments, for fiſhing—Rondelet ſays, that the bowels taken out, the body appears tranſparent; and with a lighted candle in it, has a formidable appearance—fiſhermen have a great regard for this ugly fiſh, as an enemy to the dog-fiſh—when taken they ſet it at liberty, vi. 281, 282

Fiſſures, perpendicular, found in every field, and every quarry—their cauſes, i. 62

Fiſtularia, deſcription of this fiſh, vi. 307

Flame will burn under water—none found continuing to burn without air, i. 333

Flamingo, the moſt remarkable of the crane kind; the talleſt, bulkieſt, and moſt beautiful—its deſcription—chiefly found in America—once known on all the coaſts of Europe—in deſerted regions, the flamingos live in a ſtate of ſociety, and under a better polity than others of the feathered creation—delicacy of its fleſh—when the firſt Europeans in America killed one, the reſt regarded the fall in fixed aſtoniſhment; thus the fowler levelled the flock, before any began to eſcape—it is now one of the ſcarceſt and ſhyeſt birds in the world—places it chiefly inhabits—always appoint one as a watch, who gives notice of danger, with a voice as ſhrill as a trumpet—negroes fond of their company, and think their ſociety a gift from heaven, and protection from evils—thoſe killed hidden in the long graſs, to prevent ill treatment from the blacks diſcovering the murder of their ſacred birds—are frequently taken with nets—refuſe all nouriſhment, when taken, pine and die, if left to themſelves in captivity—its tongue is the moſt celebrated delicacy; a diſh of them, ſays Labat, is a feaſt for an emperor—a Roman emperor had fifteen hundred flamingos tongues ſerved up in a diſh—their tongue larger than that of any other bird—its fleſh—they move in rank like cranes—appear in flight of a bright red as a burning coal—manner of feeding very ſingular—ſavages of Canada call it *tococo*, and why—time of breeding, and their neſts—number of their eggs—colour when young—then become familiar in five or ſix days, eat out of the hand, and drink ſea-water; but generally pine away, wanting their natural ſupplies, and die in a ſhort time—ſavages make ornaments of their plumes; and the ſkin ſometimes ſerves the Europeans to make muffs, vi. 10 to 19

Flea, perſecutes the hare, iv. 12—it can draw a chain a hundred times heavier than itſelf, and eat ten times its own ſize of proviſion in one day, vii. 248—its deſcription, 268—arboreſcent water-flea, or monoculus, deſcribed, 288—Leuwenhoeck has diſcovere above ſix thouſand facets on the cornea of a flea, viii 36

Flemings, poſſeſſed the art of cloth-working in a ſuperior degree—were invited to ſettle here, iii. 43

Fleſh, dries at Cuſco like wood, without corrupting ii. 274—the Perſians eſteem that of the wild aſs ſo highly, that its delicacy is a proverb among them, 378—of the fallow-deer, preferred to any other, iii. 125—of the roe-buck, between one and two years old, allowed the greateſt delicacy known, 139—of the tiger, is good for food; ſome hold it ſuperior to mutton, 249—of dogs, ſold in ſhambles all over China; and the negroes of the coaſts of Guinea eſteem it a delicacy, as likewiſe that of toads, lizards, and tigers, 297, 298—that of the wolf very indifferent; no creature known to eat it but the wolf himſelf, 323—of the ſquaſh, tolerable food, 385—that of the glutton not fit to be eaten, 402—of the hare, religiouſly abſtained from by Jews, ancient Britons, and Mahometans, iv. 14—of the paca, conſidered a great delicacy, 54—of the tendrac, thought by the Indians a great delicacy, 107—of the pangolin, conſidered a very great delicacy by the negroes of Africa, 121—of the armadilla, or tatou, ſaid to be delicate eating, 130—of the ſeal, formerly found place at the tables of the great, 180—of the monkey, liked by the negroes, 224—of the oſtrich, proſcribed in ſcripture, unfit to be eaten, v. 53—of the emu, or the American oſtrich, good to be eaten, 67—of the dodo, good and wholeſome eating, 77—of the vulture, falcon, and of prey, when young, excellent food, according to Belonius, 85—that of carnivorous birds ſtringy and ill taſted, ſoon corrupting, and tinctured with that animal food upon which they ſubſiſt, 84—of the bird condor, as diſagreeable as carrion, 102—of the peacock, keeps longer unputrefied than of any other animal, 173—of the pheaſant, conſidered as the greateſt dainty—of the quail, a very great delicacy, 214—that of the partridge, ſo valued by the French, according to Willughby, that no feaſt could be complete without it, 206—of the toucan, tender and nouriſhing, 246—of young herons, in particular eſtimation in France, 398—of the bittern, greatly eſteemed among the luxruious, vi. 5—of the puffin, formerly by the church allowed on lenten days, 102—of fiſhes, yields little nouriſhment, 178—queſtion propoſed to the learned concerning it, 179—of the young porpeſſe, ſaid to be as well taſted as veal, 283—of the ſhark, is hardly digeſtible by any but negroes, who are fond of it to deſtraction, 243—of the turtle, is become a branch of commerce, 392—that of ſome crabs is poiſonous, 370—of the great Mediterranean turtle ſometimes poiſonous, 388

Flies, torment the elephant unceaſingly—arts the elephant tries to keep them off, iv. 266—dragon-fly, or the libella, vii. 316—common water-fly, ſwims on its back, 359—the cornea ſo adapted by Puget, as to ſee objects through it with a microſcope—ſtrangeneſs of its repreſentations—does the fly ſee objects ſingly, as with one eye; or is every facet a complete eye, exhibiting its object diſtinct from the reſt, viii. 36, 37—the Spaniſh fly, 141. See *Cantharides*.

Flintſhire, in a lead mine there, two great grinding teeth, and part of the tuſk of an elephant, diſcovered, at the depth of forty-two yards, iv. 282

Flounder, known to produce, in one ſeaſon, above one million of eggs, vi. 174

Fluids, aſcending in veſſels emptied of air—riſing in capillary tubes, and how this comes to paſs, i. 192

Flumide, deſcription of this fiſh, vi. 306

Flux of the ſea, i. 250—not equal in the Streight of Magellan, 259

Fly-catcher, bird of the ſparrow kind, v. 317

Flying-fiſh, its deſcription, vi. 308—chiefly ſought by the dorado, 335

Fly-trap, name of a flower, cloſing upon the flies that light upon it, viii. 162

Fœtus, the canal of communication through which the blood circulates in the fœtus, without going through the lungs, has been found open in ſome bodies that have been diſſected, vii. 58

Fongwhang, natives of China give a fantaſtic deſcription of this imaginary bird, v. 191

Fontenelle, a celebrated writer, of a weak and delicate habit of body; the remarkable equality of his temper lengthened out his life to above an hundred—nothing could vex or make him uneaſy, ii. 201

Food, man can live without it for ſeven days, ii. 132—a Scotchman, for the ſpace of ſix weeks, took no food at all, 133

Foot, hares have the ſole of it furniſhed with hair, iv. 8. See *Hare* and *Hair*.

Foramen ovale, opening in the heart of the fœtus, ii. 45—in the ſeal's heart, never cloſes, iv. 171

Forbin, (chevalier) his account of baboons forcing women in Siam, iv. 210

Forehead, narrow, liked by the Romans, ii. 76

Foreſts, generally divided between monkies and ſerpents, iv. 221

Formica-leo, the *lion-ant*, deſcribed—its habits—retreat—contrſvances for catching other inſects—when attaining a certain age, changes its form—deſcription, when become a large and beautiful fly of the libellula kind, vii. 323 to 330

Foſſile, teeth of elephants often found in that ſtate, iv. 282—bones found in Peru and Braſil, 283—ſhells in the bowels of the earth, not found in the ocean, vii. 15

Fouine, animal of the weaſel kind, iii. 368

Fowls, large, do not riſe eaſily, and why, v. 8—few water-fowls known to breed in England, and why, 33—thoſe of reddiſh plumage the ancients held invaluable; the white, as unfit for domeſtic purpoſes, and fit as prey to rapacious birds—Ariſtotle thinks them leſs fruitful than the former, 162—ſea-fowls ever ſporting on formidable ſea-coaſts, vi. 76—general characteriſtics of water-fowls—their food—the gull kind—the penguin kind—the gooſe kind, 43 to 48—water-fowls properly of no climate, 104

Foxes, hunt in packs, iii. 276—their cubs born blind, like thoſe of the dog—the fox lives about twelve or fourteen years—remarkable inſtance of parental affection of a ſhe-fox—all animals make war upon the fox—even the birds—refuſes to engender with the dog—brings forth fewer than the dog, and but once a year

—the female goes with young ſix weeks, and ſeldom ſtirs out while pregnant—various colours of them—three varieties of this animal in Great Britain; grey-hound fox, maſtiff-fox, and cur-fox—round the pole they are all colours—jackall taken for the fox—ſkin of the black fox moſt eſteemed, a ſingle ſkin ſelling for forty or fifty crowns, 329 to 333—in Greenland, do not change colour at all, 356—taken young, are gentle only while cubs; growing older, diſcover their natural appetites of rapine and cruelty, 277—nothing eatable comes amiſs to them, rats, mice, ſerpents, toads, and lizards; inſects, crabs, ſhrimps, and ſhell-fiſh; carrots, wax, and honey; even the hedge-hog, 327—chace of the fox—their offenſive ſmell often the cauſe of their death—way they find to ſubſiſt—name given by huntſmen to a fox of the ſecond year—old fox the name for the third year, 324 to 328—many animals in this country bred between a dog and a fox, 298—experiments prove neither the wolf nor the fox of the ſame nature with the dog, each a ſpecies perfectly diſtinct, 298 to 301—exactly reſembles the wolf and the dog internally, 323—deſcription—eyes, obliquely ſituated, like the wolf, 324—often takes poſſeſſion of the hole quitted by the badger, or forces it from its retreat by art, iv. 328

Fox (croſt) name of the *iſatis*, when turning white, iii. 341

Fox-tailed monkey, of the ſagoin kind, iv. 237

France, its kings of the firſt race had whiſkers knotted and buttoned with gold, ii. 97—under Francis I. peacocks ſerved up at the tables of the great, not to be eaten, but ſeen, v. 173

Fray, ſaid when ſtags rub off the peel of their horns againſt trees, iii. 114

Frederic, emperor of Germany, wrote a treatiſe upon hawking, v. 118

Friezeland, great inundations happened in it, i. 278

Friſchehaff, a lake where the ſturgeon is found in greateſt numbers, vi. 273

Frog, deſignedly introduced into Ireland before the Norway rat, iv. 66—the rat put a ſtop to their increaſe, and the frog is almoſt extinct in that kingdom, 67—

differences between it and the toad, in figure and conformation, vii. 74—the frog the beſt ſwimmer of all four-footed animals—its deſcription—male or female have no external inſtruments of generation; the anus ſerving for that purpoſe in both—coupling of the common brown frog—experiments to diſcover how their impregnation is performed—the female not impregnated by the mouth, as conjectured, nor by the thumbs, as imagined by Linnæus, but by imperſion of male ſeminal fluid upon the eggs proceeding from the body—how the female brings forth eggs—various changes in the eggs, after impregnation by the male—the animal in its perfect ſtate, from feeding upon vegetables, becomes carnivorous, lives upon worms and inſects, and ſeeks for food upon land—myriads ſeen on ſuch occaſions, have been fancied to be generated in the clouds, and ſhowered down on earth—their habitudes and food—differences of ſexes not perceivable until their fourth year—do not begin to propagate till that period—live about twelve years—a German ſurgeon kept one eight years in a glaſs covered with a net; fed it often, but ſparingly—inſtances of tenaciouſneſs of life—the male only croaks—large water-frog's note as loud as the bellowing of a bull, and heard at three miles diſtance—times of their croaking—no weather-glaſs ſo true in foretelling changes—adhere to the backs of fiſhes—ſtory of Walton to this purpoſe—dry weather hurtful to frogs, 75 to 89. See *Fiſhing-frog*.

Froſt, dry, augments evaporation, i. 371

Froſt-ſmoke, fogs near the pole form halos, or luminous circles, i. 386, 387

Froth-worm, its deſcription, vii. 358

Fumes of hot iron, copper, or other metal, blown into the place where an animal is confined, inſtantly deſtroys it, i. 319

Fur, the colder the country, the larger and the warmer the fur—inſtances of it, ii. 329—of the white fox not eſteemed, and why, iii. 333—the iſatis of no value, unleſs killed in winter, 341—the ermine the moſt valuable of any, 354—no eaſy matter to account for warmth of furs of northern quadrupedes, or how they come to have ſuch abundant covering—particulars on this ſubject, 355—white weaſel, found in Great Britain, of no value, 358—ermine, in every country, changes by time, 359—of the polecat, in leſs eſtimation than ſome of inferior kinds, 366—of the yellow-breaſted martin, more valuable and beautiful than the white, 368—different colours of the ſable, 374—of the genet, valuable, 388—of the civet, impregnated with the perfume, 392—of the glutton, has the moſt beautiful luſtre, and is preferred to all, except the Siberian ſable, 403—of the hare, forms a conſiderable article in the hat manufacture, iv. 13—of the cricetus, or German rat, very valuable, 84—inſide down of the vulture's wing makes a warm and comfortable kind of fur, v. 109

G.

Gadfly, formidable in Lapland—brings on an incurable diſorder upon the rein-deer—precautions uſed gainſt them, iii. 157

Gadus, the cod-fiſh, its deſcription, vi. 306

Gaganda, iſland of Ethiopia, parrots found there by the Romans, v. 284

Galam, a place nine hundred miles up the Senegal, taken from the French, i. 212

Galen aſſerts the eggs of hens and pheaſants good to be eaten; thoſe of geeſe and oſtriches worſt of all, v. 63

Galinaſſos, Spaniſh name of vultures in America, v. 113

Gall of the ſhammois held uſeful to ſtrengthen the ſight, iii. 69—the deer kind have none, 94

Gall-nuts, deſcription of the inſect forming and reſiding in them, and its transformations, viii. 148

Galley-fiſh, its deſcription—its legs adheſive—common in America, perpetually floating—no efforts made to hurt can make it ſink—never perceived to move on ſhore, ſo ſtrongly adhering to whatever ſubſtances applied—the ſmalleſt quantity of ſlimy ſubſtance from its legs burns the ſkin like hot oil—the ſhore covered with them, a fore-runner of a ſtorm, vi. 289, 290

Galley-worm, its difference from the ſcolopendra, vii. 303

Game, ſanguinary laws to preſerve it, iii. 110

Ganges, a river viſited annually by a hundred tho ſand pilgrims, who pay their devotions to it as to Go i. 211—in its courſe receives twenty rivers, 217

Gannet, the ſoland gooſe, its deſcription—ſubſiſts upo fiſh—places abounding with them—manner of preſerv ing them and their eggs, in the iſland of St. Kilda twenty-three thouſand of this kind of young birds con ſumed annually there—a bird of paſſage—its migration —never comes near the land—where ſeen, it announce the arrival of herrings—exceeds the cormorant in quick neſs of ſight—method of taking its prey—manner o taking them at ſea—number of their eggs—the young counted a great dainty, and ſold very dear, vi. 69 to 7

Garter-fiſh, the lipidopus, its deſcription, vi. 306, 30

Gaſteroſteus, or the ſtickleback, deſcription of thi fiſh, vi. 303

Gazelles, neither goat nor deer—partake of both na-tures—they form a diſtinct kind—their deſcription— of all animals it has the moſt beautiful eye—eaſtern poets compare the eyes of their miſtreſſes to thoſe of th gazelle — Buffon makes but twelve varieties — thei names and deſcriptions, iii. 70 to 80—comparing them together, we find but ſlight diſtinctions—are inhabi-tants of the warmer climates—no animals, but of the winged kind, can overtake them—are purſued by fal-cons; and this hunting is a principal amuſement among the great in the Eaſt—alſo hunted with the ounce— another way of taking them—keep in ſolitary and in-acceſſible places, 83 to 87—the bubalus, more pro-perly one of Africa, 149—the moſt uſual prey for the lion in deſerts and foreſts, 223—the prey of the pan-ther, 260 — purſued by the jackall, makes towards houſes and towns, 337

Gekko, a kind of ſalamander, vii. 141

Generation, moſt complete where feweſt animals are produced, ii. 48—late diſcovery, that male fiſhes have two organs of generation, vi. 175—all animals of the ſnail kind are hermaphrodites; each containing the in-ſtruments of generation double, vii. 30—theſe organs in the muſcle, 42—male or female of frogs have no ex-ternal inſtruments for that uſe, 76

Gennette, its odour more faint than civet—deſcription of this animal—reſembles the martin; more eaſily tamed—Belonius has ſeen them at Conſtantinople tame as cats—glands open differently from others of its kind—called the cat of Conſtantinople—never found in mountains, or dry places—its fur valuable—ſpecies not much diffuſed—countries where it is found—the moſt beautiful, cleanly, and induſtrious animal—keeps a houſe free from mice and rats by its ſmell, iii. 386 to 388

Gennette, of the province of Andaluſia the beſt, ii. 357

Georgians, their deſcription, ii. 230

Gerbua, has four feet; uſes only the hinder in running or reſting—the ſwifteſt creature in the world—deſcription—countries where found—live upon vegetables, and burrow like rabbits—its habits, iv. 347 to 349

Gerenda, a ſerpent to which the natives of Calicut, and thoſe of the Mozambique coaſt, pay divine honours, vii. 224

Geſner minutely deſcribes a variety of mice-traps, iv. 74—places bats among birds, 134

Giant, in England, as late as king James I. the court had one, ii. 251

Giants, probability of the race affirmed, poſſibility of their exiſtence denied—Grew's opinion—Ferdinand Magellan, a Portugueſe, firſt diſcovered a race of ſuch people, towards the extreme coaſt of South America—aſſent to the exiſtence of this gigantic race of mankind—travellers confirm it—ſeen here, have the ſame defects of underſtanding as dwarfs—are heavy, phlegmatic, ſtupid, and inclined to ſadneſs, ii. 258 to 263

Gibbon, the long-armed ape, its deſcription, iv. 206

Gills, their free play prevented, the animal falls into convulſions, and dies, vi. 166

Gilthead, called dolphin by ſailors—its deſcription, vi. 299

Gimerro, imagined a breed between an aſs and a bull, ii. 386

Glands, furniſh the fœtid ſubſtance in animals of the weaſel kind, iii. 352—of the genette, open differently from others, 387—unctuous in birds, to preſerve their feathers, v. 4—ſalivary in the gullet and crop of birds, 15

Glaſs, a looking-glaſs held to the mouth of a perſon ſuppoſed dead, an uncertain experiment for determining latent life, ii. 209

Glitters, little impreſſions ſo called in the heads of ſtags, iii. 114

Globe of fire riſing from the ſide of the mountain Pichinca—a great one ſeen at Bononia, in Italy, in the year 1676—paſt weſtward at a rate of a hundred and ſixty miles in a minute—could not be leſs than a mile long, and half a mile broad, i. 381, 382

Globe of glaſs, filled with water, aſſumes ſucceſſively all the colours of the rainbow, i. 385

Glouceſter, its corporation had an old cuſtom annually to preſent the king with a lamprey pye, vi. 269

Glow-worm, male and female of this ſpecies differ entirely from each other, viii. 140—how and in what manner in which light ſent forth by the glow-worm is produced, hitherto inexplicable—the light continues to grow paler, and at laſt is totally extinct, if the worm be kept for ſome time, 141

Glue, made of the horns of the rein-deer, iii. 167—Mr. Jackſon found out a method of making glue to anſwer the purpoſes of iſinglaſs, vi. 279

Glutton, the moſt dangerous, and moſt ſucceſsful perſecutor of the rein-deer, iii. 169—its manner of killing that deer, 170—belongs to the weaſel kind—there is no preciſe deſcription of it; ſome reſembling it to a badger, ſome to a fox, others to a hyæna—one brought alive from Siberia was three feet long, and about a foot and a half high—ſo called from its voracious appetite—countries where found—called *carcajou* in North America—general deſcription—Ray and others doubt of its exiſtence—takes its prey by ſurprize, and in what manner—darts down from branches of trees upon the elk, or the rein-deer, ſticks its claws between their ſhoulders, and remains there firm, eating their necks, and digging to the great blood-veſſels that lie on that part—amaſing quantity one of theſe animals can eat at a time; that ſeen by Mr. Klein, without exerciſe or air, taken from its native climate, and enjoying but indifferent health, eat thirteen pounds of fleſh every day, and was not ſatisfied—it continues eating and ſleeping, till its prey, bones and all, be devoured—prefers putrid fleſh to that newly killed—it is ſo ſlow, that any quadrupede can eſcape it, except the beaver—purſues it upon land; but the beaver taking water, the glutton has no chance to ſucceed—called the vulture of the quadrupedes—in what manner it makes up by ſtratagem the defects of nature—the female goes with young four months, and brings forth two or three—the male and female equally reſolute in defence of their young—is difficult to be ſkinned—does not fear man—is a ſolitary animal, and never in company but with its female—couples in the midſt of winter—the fleſh not fit to be eaten—the fur has the moſt beautiful luſtre, and preferred to all, except the Siberian fox, or the ſable, 395 to 403

Gnats, in Lapland, fill the air like clouds of duſt—are chiefly enemies to the rein-deer—remedies uſed againſt them, iii. 155—proceed from a little worm, uſually ſeen at the bottom of ſtanding waters—curious manner in which the eggs are laid—in their egg ſtate it reſembles a buoy, fixed by an anchor—different ſtates of the inſect—in its laſt transformation, diveſted of a ſecond ſkin; in the next it reſigns its eyes, its antennæ, and its tail, and ſeems to expire—from the ſpoils of the amphibious animal appears a little winged inſect, whoſe ſtructure is an object of admiration—deſcription of this inſect, and of its trunk, juſtly deemed one of nature's maſter-pieces—implement with which the gnat performs its work in ſummer—places where it ſpends the winter—the little brood ſo numerous, that the water is tinged with the colour of the ſpecies—ſome gnats oviparous, others viviparous, and come forth in a perfect form; ſome are males, and unite with the female; ſome are females, requiring the male; others are of neither ſex, and produce young without copulation—at the ſixth generation their propagation ſtops, the gnat no longer reproduces its likeneſs, but requires the male to renew its fecundity—produced in multitudes beyond expreſſion in America; and found of all ſizes, from ſix inches long, to a minuteneſs beyond the perception of the common eye—native Indians, anointed with oil, ſleep in cottages covered with thouſands of gnats, and have not their ſlumbers interrupted by theſe cruel devourers, viii. 152 to 157

Goat, its eyes are grey, ii. 83—from Europe imported into South America, ſoon degenerates—as it grows leſs, it becomes more prolific—imported to the African coaſt, it ſeems to improve, 334—goat and ſheep propagate together; and may be conſidered as of one family—the buck-goat produces with the ewe an animal, in two or three generations returning to the ſheep, and retaining no marks of its ancient progenitor, iii. 35—more fitted for a life of ſavage liberty than the ſheep—is not eaſily confined to its flock, but chuſes its own paſture, and loves to ſtray from the reſt—delights in climbing precipices—is capricious and vagrant—is not terrified at ſtorms, or incommoded by rain—immoderate cold affects it, and produces a vertigo, to which this animal is ſubject—proof of its being naturally the friend of man, and that it ſeldom reſumes its foreſt wildneſs, when once reduced into the ſtate of ſervitude—in ſome places they bear twice a year—in warmer climates generally bring forth three, four, and five at once—milk of goats medicinal; not apt to curdle in the ſtomach—fleſh of the goat, properly prepared, ranked by ſome not inferior to veniſon—is never ſo good and ſo ſweet, in our climate, as mutton—no man can attend above fifty goats at a time—fleſh of the goat found to improve between the tropics—remarkable varieties in this kind—that of Natolia, by Mr. Buffon called *goat of Angora*—its deſcription—the *Aſſyrian goat* of Geſner—chiefly kept about Aleppo—*little goat of America*, the ſize of a kid; has hair as long as the ordinary breed—*Juda goat*, not larger than a hare—common in Guinea, Angola, and the coaſt of Africa—*blue goat*, at the Cape of Good Hope—its deſcription, 52 to 59—boundaries between the goat and deer kind difficult to fix—*Bezoar goat*, the *paſan*, found in the mountains of Egypt, &c. 74—*African wild goat* of Grimmius, fourth anomalous of the kind—its deſcription, 81, 82—goats eat four hundred and forty-nine plants, and reject a hundred and twenty-ſix, 176—in Syria, remarkable for their fine, gloſſy, long, ſoft hair, 212

Goat-ſucker, a nocturnal ſwallow—deſcription and habits, v. 346

Gobius, the gudgeon, deſcription of this fiſh, vi. 301

Godignus, in his hiſtory of Abyſſinia, exaggerates the effects of the ſhock of the torpedo, to an incredible degree, vi. 262

Godwit, its dimenſions, vi. 22—a bird of paſſage, 27

Goiam, kingdom, where the Nile takes its riſe, i. 213

Gold, never contracts ruſt, and why—except in places where much ſalt is uſed, i. 313

Golden-eye, bird of the duck kind, vi. 127

Goldfinch, bird of the ſparrow kind, v. 314, 315—learns a ſong from the nightingale, 345

Gooſe, marks of the gooſe kind, vi. 106—food—abſtained from by the ancients, as indigeſtible—one known to live a hundred years—marks of the tame and wild ſort—wild ſuppoſed to breed in the northern parts of Europe—flight regularly arranged, 108 to 119

Gooſe (Brent) moſt harmleſs, but for their young purſue dogs and men—uſe of its feathers in beds unknown in countries of the Levant and Aſia—feathers a conſiderable article of commerce—different qualities of them—the beſt method of curing them, vi. 120 to 123

Gooſe (Soland) deſcribed, vi. 69. See *Gannet*.

Gooſeander, a round-billed water-fowl, its deſcription—feeds upon fiſh, vi. 104, 105

Gordian, the emperor, wrote a poem upon the halcyon, of which are no remains, vi. 140

Goſs-hawk, of the baſer race of hawks, v. 119—taught to fly at game—little obtained from its efforts, 131

Gottenburgh, in Sweden, a cataract near it, i. 222

Gouan, a learned Frenchman, his ſyſtem deſerves applauſe for more than its novelty—how followed in arranging the ſpinous claſs of fiſhes, vi. 296 to 310

Graaf, his obſervations upon the progreſs and encreaſe of animals in the womb, ii. 36, et ſeq.

Grampus, fierce and deſperate in defence of its young—remarkable inſtance, vi. 184—deſcription, and habits, 217

Graſhopper, a ruminating inſect, or ſeemingly ſo, iii. 6—differences between ours and the *cicada* of the ancients—great varieties of this animal in ſhape and colour—deſcription of the little graſhopper, that breeds plentifully in meadows, and continues chirping through the ſummer—the male of this tribe only vocal—how their fecundation is performed—the male or female never ſurvive the winter—their eggs—from firſt appearing, poſſeſſed of wings—how it gets rid of the outer ſkin—their food—places where they depoſit their eggs, vii. 331 to 340

Grave, the greateſt care recommended not to commit thoſe deareſt to us to the grave, before real ſigns of certain death be aſcertained, ii. 210

Greatah, river in Yorkſhire running under ground, and riſing again, i. 224

Grebe, deſcription of the bird—reſidence, and habits perpetually diving, and very difficult to be ſhot—never ſeen on land—chiefly ſought for the ſkin of its breaſt, and why—in breeding-time their breaſts are bare, vi. 38, 39

Greenfinch, bird of the ſparrow kind, v. 315, 317

Greenland, Krantz's account of the formation of ice-mountains in that country, i. 246—*aurora borealis*, its appearance almoſt conſtant in winter—the inhabitants not entirely forſaken in the midſt of their tedious night; this *aurora* affording them light for the purpoſes of exiſtence, 386, 387—they live moſtly upon ſeals—their number daily diminiſhing, and why, iv. 182

Greenlanders, deſcribed, ii. 213—cuſtomary among them to turn Europeans into ridicule, 216—a quiet, or a modeſt ſtranger, they deem almoſt as well bred as a Greenlander, 217

Grew, his opinion concerning dwarfs and giants, ii. 258

Greyhound kind, iii. 284—*grehound-fox*, 332

Gris, the *petit gris*, Mr. Buffon's name for the grey Virginian ſquirrel, iv. 25

Groſsbeak, bird of the ſparrow kind, v. 315

Grotto of Antiparos, in the Archipelago, the moſt remarkable ſubterraneous cavern now known—deſcription, i. 67 to 71

Grotto del Cane, near Naples, ſituation and deſcription—noxious effects, i. 84, 85

Grous, chiefly found in heathy mountains and piny foreſts, v. 199

Growth of the child leſs every year, till the time of puberty, when it ſtarts up of a ſudden, ii. 60—growth of the mind in children correſponds with that of the body, and why, 61—of ſome young people, ceaſes at fourteen, or fifteen; in others, continues till two or three and twenty, 79—of fiſhes, irregular and tardy, vi. 333, 334

Guadalquiver, river in Spain, buried in the ſands, i. 124

Guanacoes, a kind of camel in America, iv. 317

Guanches, ancient inhabitants of the iſland of Teneriff—art of embalming ſtill preſerved among them, when the Spaniards conquered the iſland, ii. 272

Guariba, Braſilian guariba, or warine, the largeſt of the monkey kind in America, deſcribed, iv. 236

Guayaquil, river in South America, i. 147

Gudgeon, freſh-water ſort has no bladder, vi. 170—deſcription of that fiſh, 301

Guiba, animal reſembling the gazelle—its deſcription, iii. 81

Guillemot, bird of the ſmaller tribe of the penguin kind, vi. 97

Guinea, the natives kill numbers of hares at a time, and in what manner, iv. 14

Guinea-aſs, larger and more beautiful than the horſe, ii. 385

Guinea-hen, deſcribed, v. 192

Guinea-horſe, remarkable ſports with it among the grandees of that country, ii. 363

Guinea-pig, by Briſſon placed among the rabbit kind—native of the warmer climates—rendered domeſtic, and now become common every where—its deſcription—in ſome places a principal favourite; often diſplacing the lap-dog—manner of living among us—moſt helpleſs and inoffenſive, ſcarce poſſeſſed of any courage—their animoſity exerted againſt each other; often fight obſtinately, and the ſtronger deſtroys the weaker—no natural inſtinct; the female ſees her young deſtroyed, without attempting to protect them—ſuffer themſelves to be devoured by cats—fed upon recent vegetables, they ſeldom drink—ſometimes gnaw cloaths, paper, or other things of the kind—drink by lapping—confined in a room, ſeldom croſs the floor, but keep along the wall—never move a-breaſt together—chiefly ſeek the moſt intricate retreats, and venture out only when all interruption is removed, like the rabbits—in cold weather more active—a very cleanly animal—their place muſt be regularly cleaned, and a new bed of hay provided for them once a week—the young falling into the dirt, or other ways diſcompoſed, the female takes an averſion to them, and never permits them to viſit her more—her employment, and that of the male, conſiſts in ſmoothing their ſkins, diſpoſing their hair, and improving its gloſs; and take this office by turns—do the ſame to their young, and bite them when refractory—reared without artificial heat—no keeping them from fire in winter, if once permitted to approach it—manner of ſleeping—the male and the female watch one another by turns—generally capable of coupling at ſix weeks old—time of their geſtation—the female brings forth from three to five at a time; not without pain—the female admits the male the very day ſhe has brought forth, and again becomes pregnant—ſuckles her young about twelve or fifteen days; and ſuffers the young of others, though older, to drain her, to the diſadvantage of her own—produced with eyes open, and in twelve hours equal to the dam in agility—capable of feeding upon vegetables from the beginning—their diſputes for the warmeſt place, or moſt agreeable food—manner of fighting—fleſh indifferent food—difficultly tamed—ſuffer no approaches but of the perſon who breeds them—manner of eating—drink ſeldom, and make water often—grunt like a young pig—appear to chew the cud, iv. 55 to 62

Guinea-ſheep, have a kind of dewlap under the chin—breed with other ſheep, therefore not animals of another kind, iii. 48

Guiratemga, name given by the natives of Braſil to the little *wood-pecker*, v. 255

Gull, places where found in plenty—their food, vi. 75

Gulls, various ways of impoſing upon each other—conteſts in breeding—reſidence, with their neſts and eggs—their fleſh—method of taking them in the Feroe iſlands—anciently a law in Norway concerning thoſe who died in taking them, vi. 78 to 80

Gulph, the Perſian—deadly wind along its coaſts, i. 358—chief pearl-fiſhery carried on there, vii. 56

Gun, wind-gun, inſtrument determining the elaſticity of the air—a ball from it pierces a thick board, i. 307—great guns, in climates near the equator, with every precaution, after ſome years, become uſeleſs, and why, 313

Gunpowder, readily fires with a ſpark, not with the flame, i. 83—will not go off in an exhauſted receiver—a train of gunpowder laid, one part in open air, the other part in vacuo, the latter will remain untouched, 333

Gurnard, deſcription of this fiſh, vi. 303

Guſtavus Adolphus attempted in vain to form a regiment of Laplanders, ii. 215

Guts, moſt birds have two blind guts, which in quadrupedes are found ſingle, v. 16

Gymnotus, the *carapo*, deſcription of this fiſh, vi. 305

Gyr-falcon, exceeds all others in largeneſs of ſize—its deſcription, v. 120

Gyrle, name given by hunters to the roe-buck, the ſecond year, iii. 136

H.

Habit contracted during life, to make out pleaſures or pains in extremes, though either can hardly be ſuffered or enjoyed to the utmoſt, ii. 208

Haddock, a periodical ſhoal appeared on the Yorkſhire coaſts, on December 10, 1766, and exactly on the ſame day in the following year, vi. 320

Hæmorrhois, a kind of ſerpent, vii. 215

Hail, Carteſians ſay, is a frozen cloud half melted and frozen again in its deſcent—the moſt injurious meteor known in our climate—hail-ſtones fourteen inches round—ſtruck out an eye of a young man, and killed him on the ſpot—a dreadful ſhower, recorded by Mezeray, fell in 1510; the hail-ſtones were of a blueiſh colour, and ſome weighed an hundred pounds—the fiſhes were great ſufferers in that general calamity, i. 373 to 376

Hair of the Roman ladies praiſed for the redneſs of its ſhade, ii. 76—found moſt different in different climates—marks the country and the diſpoſition of the man—by the ancients held a ſort of excrement, produced like the nails—according to moderns, every hair lives, receives nutriment, fills, and diſtends, like other parts of the body—takes colour from the juices flowing through it—each, viewed with a microſcope, conſiſts of five or ſix leſſer, wrapped up in one common covering, and ſends forth branches at the joints—ſuitable to the ſize or ſhape of the pore through which it iſſues—bulbous at the root, and its end reſembles a bruſh—length and ſtrength of hair a mark of a good conſtitution—Americans and the Aſiatics have it thick, black, ſtrait, and ſhining—inhabitants of the torrid climates of Africa have it black, ſhort, and woolly—the people of Scandinavia have it red, long, and curled—opinion that every man has diſpoſitions reſembling thoſe of the inhabitants of countries he reſembles in the colour and nature of his hair—curled hair among us a beauty—the Greeks have taken one of their national diſtinctions from the length and ſtraitneſs of the hair—Americans take the greateſt pains in cutting their hair—variety in cuſtoms and manner of cutting hair, 86 to 97—trade of the inhabitants of Angora with the hair of animals of their country—camlet and other ſtuffs made of it, iii. 58—hair of the cat rubbed in the dark ſends forth ſhining ſparks, 207—Syria and Perſia noted for long ſoft hair to the animals bred in them, 212—each hair of the lynx is of three different colours, 257—of the black fox, ſo diſpoſed, as impoſſible to tell which way the grain lies, 333—coats of hair ſeem to thicken at the approach of winter—among quadrupedes, as among men, thin ſpare diet produces hair, 355—on the ſoles of the feet, and on the inſide of the mouths of hares, iv. 8

Halcyon, rapacious water-fowl, vi. 141. See *Kingfiſher*.

Halley, Dr. his plauſible theory to explain the invariable motion of the winds, i. 343

Hallontide, in 1580, an army of mice ſo over-run the marſhes near Southminſter, that they eat up the graſs to the roots, v. 148

Halos, oftener ſeen in countries near the poles, than any other part of the earth, i. 386

Hammer, the yellow, bird of the ſparrow kind, v. 315, 317

Hamſter, the cricetus or German rat of Buffon, iv. 81

Hand, ſufficient to vindicate the dominion of man over other animals, a poor aſſertion, iv. 249—a man, without hands or legs, converts his ſtumps to moſt convenient purpoſes, and performs aſtoniſhing feats of dexterity, 250, 251

Harbour of a ſtag, in covert or thicket, iii. 114

Hare, a gregarious animal, where it has no enemies but beaſts of the foreſt, iii. 2—the ſwifteſt animal for the time it continues to run, iv. 1—animals of the hare kind inoffenſive and timorous—placed by Pyerius among thoſe that chew the cud—whether or not, certainly the lips continually move, ſleeping or waking—that kind remarkably ſalacious, and furniſhed by nature with ampler powers than others for propagation—if not thinned by conſtant depredations, would over-run the earth—of theſe the hare the largeſt and moſt timorous—has large prominent eyes, placed backwards, to ſee behind as it runs—theſe never cloſed; it ſleeps with them open—the ears moveable, and capable of direction to every quarter—muſcles of its body ſtrong, and without fat—hinder feet longer than the fore, on account of ſpeed—perſecuted by dogs, cats, weaſels, and birds of prey—in a ſtate of engendering very early—females go with young thirty days, and bring forth three or four at a time—has young of different ages in her womb together—though already impregnated, ſhe admits the male, and receives a ſecond impregnation—reaſon of this extraordinary circumſtance—the young brought forth with their eyes open—the dam ſuckles them twenty days—food they are fond of—ſleep or repoſe in their form by day, and live only by night—the rutting ſeaſon begins in February—the male purſues and diſcovers the female by the ſagacity of its noſe—the ſlighteſt breeze, or falling of a leaf, diſturbs their revels; they inſtantly fly off, each taking a ſeparate way—are more eaſily taken than the fox; a much ſlower animal than they, and why—always chuſe to run up hill, and why—have the ſole of the foot furniſhed with hair, and ſeem the only animals with hair on the inſide of the mouth—live ſeven or eight years, and come to perfection in one year—females live longer—Mr. Buffon makes a doubt of it—ſeldom heard to cry, except when ſeized or wounded—their cry nearly like the ſqualling of a child—are eaſily tamed—though never ſo young, regain their native freedom at the firſt opportunity—have a good ear, and been taught to beat the drum, dance to meaſure, and go through manual exerciſe—make themſelves a form where the colour of the graſs reſembles that of their ſkin, open to the ſouth in winter, and to the north in ſummer—ſore hunted, will ſtart a freſh hare, and ſquat in its form—ſome enter holes like the rabbit, by hunters termed going to vault—as it tires, treads heavier, and its ſcent is ſtronger—young hares tread heavier than old—male makes doublings of greater compaſs than the female—divided by hunters into mountain and meaſled hares—mode of expreſſion, the more you hunt, the more hares you ſhall have, and why—what animals perſecute the hare—its enemies ſo various, that it ſeldom reaches the ſhort term limited by nature—in countries near the north pole, they become white, and are often in great troops of four or five hundred—their ſkins ſold for leſs than ſeven ſhillings a hundred—the fur known to form a conſiderable article in the hat manufacture—found alſo entirely black, in much leſs quantity than the former—ſome have been ſeen with horns, but rarely—thoſe in hot countries ſmaller than ours—thoſe in the Milaneſe the beſt in Europe—ſcarce a country where not found, from the torrid zone to the polar circle—natives of Guinea kill numbers at a time; in what manner—the Jews, ancient Britons, and Mahometans, all conſidered it as an unclean animal, and religiouſly abſtained from it—hare and rabbit diſtinct kinds—refuſe to mix with each other—an inſtance—laws made for the preſervation of them, iv. 1 to 16

Harfang, or great Hudſon's-Bay owl, the largeſt of the nocturnal tribe, v. 141

Harlequin, a kind of dog, iii. 286, 290

Harmony of our planetary ſyſtem, i. 4

Harold. See *Hawk*, v. 118

Harp, the ſtory of Arion's gathering the dolphins about the ſhip, ii. 168

Harpies, that ancient idea taken from the rouſette, or the great bat of Madagaſcar, iv. 143

Harrier, hound, and beagle, all of the ſame kind, iii. 283, 284—a dog of the generous kind, 286

Hart, name of the ſtag the ſixth year, iii. 113

Hartſhorn and muſk, the only medicines of reputation of ſeveral procurable from quadrupedes, iii. 69

Harvey, his opinion about the formation of the incipient animal—altercations againſt his ſyſtem, ii. 17

Hatching, nothing exceeds the patience of birds hatching, v. 26—Mr. Addiſon's obſervations to this purpoſe, 27—the emu very peculiar in the hatching of its young, 66—the crocodile's eggs hatched in the ſand, vii. 134, 135

Hatfield, in Yorkſhire, deſcription of one of thoſe ſpouts called typhons, obſerved there in 1687, i. 394

Havannah, in the fortunate expedition which gave us that place, the climate left not a fifth part of the army ſurvivors of the victory, i. 323

Hawfinch, a bird of the ſparrow kind, v. 317

Hawk kind—hawk deſtroys mice, iv. 73—perceives a lark at a diſtance which neither men nor dogs could ſpy, v. 10—diſtinctive marks from other carnivorous birds, 85—in old paintings, the criterion of nobility; no perſon of rank ſtirred out without his hawk on his hand—Harold, afterwards king of England, going on an important embaſſy into Normandy, is drawn in an old bas-relief, embarking with a hawk on his fiſt, and a dog under his arm—in thoſe days, it was ſufficient for noblemen's ſons to wind the horn, and carry the hawk fair—this diverſion in ſuch high eſteem among the great all over Europe, that Frederic, emperor of Germany, wrote a treatiſe upon hawking—this amuſement now much given over in this kingdom, and why—in the reign of James I. Sir Thomas Monſon gave a thouſand pounds for a caſt of hawks—in the reign of Edward III. it was made felony to ſteal a hawk—to take its eggs was puniſhed by impriſonment for a year and a day, with a fine at the king's pleaſure—in the reign of Elizabeth, the impriſonment reduced to three months, the offender to lie in priſon till he got ſecurity for his good behaviour during ſeven years—in earlier times, the art of gunning was but little uſed, and the hawk was then valuable for its affording diverſion, and procuring delicacies for the table, not otherwiſe to be obtained—diſtinctive marks of the tribe called the long-winged hawks—their names and deſcriptions—have attachment to their feeder, and docility the baſer race are ſtrangers to—names of hawks of the baſer race—thoſe of the generous breed remarkable for courage, ſwiftneſs, and docility, in obeying the commands and the ſigns of their maſter—account of the manner of training a hawk—falconers had a language peculiar, in which they converſed and wrote, 117 to 124

Hawk (ſparrow) purſues the thruſh and the linnet, v. 81—ſaid to be the boldeſt and beſt of all others for the chace, 131

Hawk (goſs) and ſparrow-hawk unfit for training—taught to fly at game, but little obtained from them, v. 130, 131

Hawkins, Sir Robert. See *Azores*, i. 239

Head of man externally and internally different from that of all other animals, the monkey kind excepted, ii. 101—whence originally the flat heads of the American Indians, 239—of quadrupedes, different from each other, but adapted to their ſeveral ways of living, and how, 314—in all birds, except nocturnal, the head ſmaller, and leſs proportioned to the body, than in quadrupedes, v. 9—of the great Greenland whale, makes a third of its bulk, vi. 190

Hearing, extreme delicacy of this ſenſe in birds, v. 11—that ſenſe in whales, vi. 192

Hearſe, name of the female of the ſtag, the ſecond year, iii. 113

Heart, a broken heart, in common language, a diſorder cauſed by hunger, ii. 129

Heat, Boerhaave conſidered it ſo prejudicial to health, that he never went near a fire, i. 325. See *Blood*, iv. 45

Hecla, the bellowings of that volcano believed by the inhabitants of Iceland to be the cries of the damned, i. 88

Hedge-hog, the moſt harmleſs of animals, iv. 100—its deſcription—uſual appearance upon the approach of danger—to diſguſt its enemy from purſuit, ſheds its urine, the ſmell of which is ſufficient to ſend him off—ſleeps by day, and ventures out by night—places where found—its food—does not ſuck cattle—are not hurtful in gardens or orchards—the ſpines ſo diſpoſed, that no fruit will ſtick upon them—appears ſerviceable in ridding the fields of inſects and worms—Mr. Buffon accuſes it of tricks, of which, from its form and habits, one would not be led to ſuſpect it—he kept males and females together, but they never coupled—time of their coupling—ſleep during winter, but do not lay up proviſions for that ſeaſon—at no time eat much, and remain long without food—blood cold, and their fleſh not good for food—their ſkins converted to no uſe, except to muzzle calves from ſucking, 101 to 105—deſtroyed and devoured by the fox—in what manner, iii. 327, iv. 121

Hedge-hog of the ſea, a cartilaginous fiſh of the ſea-orb kind, vi. 286

Hedge-ſparrow, a ſlender-billed bird, v. 314

Height, Maximin, the emperor, above nine feet in ſtature, ii. 118

Heliogabalus, noted for having the brains of ſix hundred oſtriches dreſſed in one diſh, v. 59

Hellebore, a quantity of the black ſort, pounded careleſsly, purged ſeveral perſons who were preſent, and the operator ſtrongly, i. 326

Helmo's (St.) fire, or the mariner's light, i. 379

Helmont, his experiment to ſhew all things made of water, i. 166

Hemiſphere, half illuminated by northern lights, i. 377

Hemlock, eat by the horſe without injury, ii. 341

Hemuſe, name hunters give the roebuck the third year, iii. 136

Hen, in the Muſeum at Bruſſels, a creature covered with feathers and hair, ſaid to be bred between a rabbit and a hen, iv. 15

Hen of the common ſort, moderately fed, lays above a hundred eggs from ſpring to autumn, v. 30—aſte three years, become effete and barren—clutches on brood of chickens in a ſeaſon—inſtances of two ver rare—number of eggs of a domeſtic hen in the yea above two hundred, being well fed, ſupplied with water, and at liberty—trodden by the cock or not, ſh continues to lay—eggs of this kind never by hatchin produce living animals—her neſt made without care—clucking ſeaſon artificially protracted, and entirely removed, in what manner—left to herſelf, would ſeldo lay above twenty eggs, without attempting to hatc them—as ſhe lays, her eggs being removed, ſhe continues to encreaſe the number—in the wild ſtate, ſeldo lays above fifteen eggs—particularities of incubation—affection and pride after producing chickens—every invading animal ſhe boldly attacks, the horſe, the hog or the maſtiff—marching before her little troop, by variety of notes, calls her train to their food, or warn them of danger—inſtance of the brood running for ſecurity into a hedge, while the hen ſtood boldly forth and faced a fox that came for plunder—artificial metho of hatching chickens in ſtoves, practiſed at Gran Cairo, or in a laboratory with graduated heat, effecte with woollen hens, by Mr. Reaumur—by theſe contrivances, from a hen naturally producing twelve chickens in the year, are obtained artificially above tw hundred, 165 to 169—common hen ſupplies the plac of the hen-pheaſant, when refuſing to hatch her eggs and performs the taſk with perſeverance and ſucceſs 188

Hen (Guinea) or *Barbary hen*, deſcribed, v. 192

Hen (water) deſcribed—reſidence and food—neſt an habits, vi. 35 to 37

Henry IV. king of Denmark, deſirous of trying th ſkill of a muſician, who boaſted he could excite men t madneſs, ſubmitted to the operation, became mad, an killed four of his attendants, ii. 169

Herculaneum overwhelmed in that eruption of Veſuvius, in which Pliny the naturaliſt was ſuffocated—its ruins lately diſcovered at ſixty feet below the ſurface, and forty below the bottom of the ſea, i. 91

Hermaphrodites, ſuch are all animals of the ſnail kind, vii.

vii. 30—the bivalve tribe are ſo too—they require no aſſiſtance from each other towards impregnation, 41

Hermetical ſealing a glaſs veſſel, the meaning of it, i. 168

Heron, a ruminating bird, iii. 5—the great heron, in former times, bred familiarly in our marſhes—not now, and why, v. 33—anatomical diſtinction in which herons differ from other birds—of this tribe Briſon has enumerated forty-ſeven ſorts—exceſſively deſtructive and voracious—ever have lean and carrion bodies—deſcription of the common heron—flies at the approach of the ſparrow-hawk—commits the greateſt devaſtations in freſh waters—a fiſh ever ſo large he will ſtrike at, though unable to carry it away—one heron, ſays Willughby, will deſtroy fifteen thouſand carp in half a year—uſual attitude, waiting for prey—food in cold and ſtormy ſeaſons—manner of fiſhing—Willughby's receipt for taking him—their neſts—never in flocks when they fiſh; but making neſts, they love each other's ſociety—fleſh of the young eſteemed in France—method uſed to obtain them—the young once excluded, the old inceſſantly provide them with an amazing quantity of fiſh—inſtance of it—by Mr. Keyſler's account, this bird may exceed ſixty years—recent inſtance of one taken in Holland, with a ſilver plate to one leg, and an inſcription, that it had been ſtruck by the elector of Cologne's hawks thirty-five years before—they contract a conſumptive diſpoſition, 392 to 400

Heron-hawking, a favourite diverſion among our anceſtors—had laws enacted for the preſervation of the ſpecies—he who deſtroyed their eggs was liable to a penalty of twenty ſhillings for each offence, v. 393

Herrera confirms the exiſtence of giants, ii. 261

Herring, its deſcription, vi. 308—of migrating fiſh, this and the pilchard take the moſt adventurous voyages—places where the herrings are in greateſt abundance—numerous enemies met in their migrations—in Cheſapeak Bay, the ſhoals ſo great, as to cover the ſhores, and become a nuiſance—that body upon our coaſts, begins to appear off the Shetland Iſles in April; forerunners of the grand ſhoal deſcending in June, and announced by the gannet, gull, &c.—fiſhermen take two thouſand barrels at a ſingle draught—places of Europe where herrings are punctual in their viſitations—doubts in every part of their migration—firſt great bank for herrings was along the Norway ſhore—before 1584, the number of ſhips from various parts of Europe, reſorting thither, exceeded ſome thouſands—quantity of herrings then aſſembled there was ſuch, that a ſpear ſtuck in the water, as Olaus Magnus aſſerts, would ſtand on end—ſoon after that period, they deſerted the Norway ſhores, and took up along the German coaſts—no cauſe aſſigned for this ſeemingly capricious deſertion—their greateſt colonies now in the Britiſh channel, and upon the Iriſh ſhores—a herring ſuffered to multiply unmoleſted and undiminiſhed for twenty years, would ſhew a progeny greater in bulk than ten ſuch globes as that we live upon, 320 to 329

Hertfordſhire, a dreadful ſtorm which happened in it, in 1697, deſcribed, i. 374

Hexagons, with Pappus, the moſt convenient figures in building—cells of bees are perfect hexagons, viii. 70

Hide of the elk, often known to turn a muſket-ball, iii. 147

Hiera, iſland in the Mediterranean, riſen and formed by ſubterraneous exploſions, i. 126, 127

Hiero. See *Archimedes*, i. 190

Hind, or female of the ſtag, has no horns—time of geſtation, and uſual ſeaſon of bringing forth—hides her young in obſcure thickets—obliged to uſe all arts to conceal them from the ſtag, the moſt dangerous of her purſuers—how ſhe defends her young, iii. 107, 108—the female ſtag ſtill ſo called the third year, 113—manner of knowing the track of a hind, 115—inhabitants of Canada have no other milk but that of the hind; and no other cheeſe but that made of it, 124—the hunters name for the roe-buck, the firſt year, 136

Hippocampus, the *ſea-horſe*, its deſcription, vi. 284

Hippocrates, his opinion about the formation of the incipient animal, ii. 16

Hippopotamos, not afraid ſingly to oppoſe the lion, iii. 225—its dimenſions, iv. 292—places where it reſides—its food—ſwims with much force, and remains at the bottom for thirty or forty minutes—it commits dreadful havock among the plantations—method the Africans uſe to frighten it back to its element—inoffenſive in its diſpoſition—never attacks mariners in their boats, unleſs inadvertently ſtruck againſt, or otherwiſe diſturbed, then it would ſend them at once to the bottom —inſtances of its great ſtrength—never goes beyond the mouth of freſh-water rivers—attacked on ſhore, and incapable of vengeance upon a flying enemy, returns to the river, and plunges in head foremoſt—the negroes, appriſed of its force, do not engage it—continues uncontrouled maſter of the river; all others fly its approach, or become an eaſy prey—moves ſlowly upon land—ſeldom goes from the river ſide, unleſs preſſed by neceſſities of hunger, or of bringing forth its young—lives upon fiſh and vegetables—natives of Africa ſay it often devours children, and other creatures ſurpriſed upon land—the young are excellent eating—the female ſeldom produces above one at a time; hearing the ſlighteſt noiſe, ſhe daſhes into the ſtream, and the young one follows her with equal alacrity—Dr. Pococke has ſeen their fleſh ſold in ſhambles like beef; their breaſt thought as delicate eating as veal—this creature, once plenty at the mouth of the Nile, now wholly unknown in Lower Egypt, and no where found but above the cataracts, 292 to 297

Hiſtorian, (natural) what his proper buſineſs, i. 7—going too much into ſpeculation certainly wrong, and why, 19—method his principal help, ii. 289—faults of ſyſtematic writers, 291, 292

Hiſtory, (natural) of all other ſciences, has the leaſt danger of obſcurity, and why, ii. 300—beſt ſet forth, as Mr. Locke has obſerved, by drawings of animals, taken from life, 307—rule in natural hiſtory, that neither horns, colour, fineneſs or length of hair, or poſition of ears, make actual diſtinctions in the kinds, iii. 60—accounts of fiſhes little entertaining; philoſophers not ſtudying their nature, but employed in increaſing their catalogues, vi. 150—Dampier has added more to it than half the philoſophers before him, 391—one of the ſtrangeſt diſcoveries in all natural hiſtory, viii. 156

Hobby, bird of the generous breed of hawks, for ſmaller game, daring larks, and ſtooping at quails, v. 122

Hogs, animals of this kind reſemble thoſe of the horſe as well as the cow kind, and in what—this kind partakes of the rapacious and the peaceful kinds—offend no animal of the foreſt—remarkable that none of this kind ever ſhed their teeth—any animal dying in the foreſt, or ſo wounded as to make no reſiſtance, is the prey of the hog, who refuſes no animal food, however putrid—in a ſtate of wildneſs, moſt delicate in the choice of its vegetables; rejects a greater number than any other—they eat but ſeventy-two plants, and reject a hundred and ſeventy—indelicacy of this animal more in our apprehenſions than in its nature, and why—in orchards of peach-trees, in North America, reject the fruit that has lain a few hours on the ground, and watch hours for a freſh wind-fall—have had mice burrowing in their backs, while fattening in the ſty, without ſeeming to perceive it—ſcent the hounds at a diſtance—by nature ſtupid, inactive, and drowſy; has paſſions more active only when incited by venery, or when the wind blows with vehemence—foreſees the approach of bad weather—much agitated on hearing any of its kind in diſtreſs—have often gathered round a dog that teazed them, and killed him upon the ſpot—their various diſeaſes—generally live, when permitted, to eighteen or twenty years; the females produce to the age of fifteen—in the wild ſtate leſs prolific, iii. 171 to 179

Hog (Guinea) and that about Upſal, deſcribed, iii. 181

Hog (water). See *Capibara*, iii. 190

Hog of Borneo. See *Babyrouessa*, iii. 193

Hog of the iſthmus of Darien, deſcribed by Wafer, iii. 196

Hohanno, a river in Aſia, its courſe, i. 210—receives thirty-five leſſer rivers, 217

Holland, a conqueſt from the ſea, and reſcued from its boſom—the ſurface of its earth below the level of the bottom of the ſea; upon approaching the coaſt, it is looked down upon from the ſea, as into a valley; is every day riſing higher, and by what means—thoſe parts, which formerly admitted large men of war, are now too ſhallow to receive ſhips of moderate burthen, i. 276

Honey, the polecat and the martin feed upon honey, iii. 358, 366—from what part of the flower it is extracted, viii. 75—two kinds of it—which to be preferred, 89—that gathered by the humble bees, 91—gathered by the black bees in the tropical climates, neither ſo unpalatable, nor ſo ſurfeiting as ours—produced by the bees at Guadaloupe. See *Bees*, viii. 90 to 92

Honeycomb, name of the ſecond ſtomach of ruminating animals, iii. 3

Hoof, of the Perſian mares ſo hard, that ſhoeing is unneceſſary, ii. 355

Hooper, name of the wild ſwan, on account of the harſhneſs of its voice, vi. 113

Horizon, ſeems wrapt in a muddy cloud, upon the approach of winter, under the line, i. 377

Horn, to wind it, and to carry the hawk fair, formerly ſufficient accompliſhments for noblemen's ſons, v. 118

Horns, in what manner thoſe of animals are produced, ii. 101—grow differently in deer from thoſe of ſheep or cows—deers horns furrowed along the ſides, and why—in every reſpect reſembling a vegetable ſubſtance, grafted upon the head of the ſtag—beauty and ſize of thoſe of a ſtag, mark their ſtrength and their vigour—the time of ſhedding them—ſevere winters retard ſhedding the horns in ſtags—generally increaſe in thickneſs and height from the ſecond year to the eighth—partake of the nature of the ſoil—their horns ſhed, they ſeek the plainer part of the country, remote from thoſe animals they are then unable to oppoſe; and walk with their heads ſtooping down, to prevent ſtriking againſt the branches of trees, iii. 97 to 101—of a ſtag, called his head—their names according to different ages of the ſtag, 113, 114—the author ſaw one, of ten feet nine inches, from one tip to the other, 141—of the elk, applied to the ſame purpoſes as hartſhorn, 148—of the rein-deer, converted into glue, 167—of the rhinoceros, ſometimes from three to three feet and a half long, compoſed of the moſt ſolid ſubſtance, and pointed to inflict moſt fatal wounds, iv. 286—of owls, nothing more than two or three feathers, that ſtand up on each ſide of the head, over the ear, v. 140

Horſe, characteriſtic marks given by Linnæus—eats hemlock without injury, ii. 341—near as the ape approaches man in internal conformation, ſo the horſe is the moſt remote, 342—wild horſes herd together, and feed in droves of five or ſix hundred—one among their number always ſtands a centinel, 343—there are but three animals of the horſe kind, 390—a horſe will not carry upon its back a weight of more than two or three hundred pounds, 112—to eſtimate the ſtrength of a horſe, is not to try what he can carry, but what he can draw—he draws a load ten men cannot move; and in ſome caſes a draft-horſe draws better being ſomewhat loaded, 114—allured by muſic, 169—not readily attacked by the lion—the combats between them in Italy, 319—one fond of oyſters, 327—from what country the horſe came originally uncertain—according to the ancients, wild horſes once in Europe—the colder climates do not agree with them, 344—how wild horſes are caught—ſet at liberty, they never become wild again—the buccaneers agreeably ſurpriſed to ſee their faithful horſes preſent themſelves again with their uſual aſſiduity, aud receive the rein, 345—wild horſes finding a tame horſe to aſſociate with them, gather round him, and oblige him to ſeek ſafety by flight, 346—this animal in its ſtate of nature in the old, not the new world—countries where wild horſes are found, 346—the natives of Angola, or Cafraria, catch a horſe only to eat him—*Arabian wild horſes*, the moſt beautiful breed, the moſt generous, ſwift, and perſevering, 347—the negroes ſhew terror and ſurprize, when firſt they ſee a horſe, 346—no Arabian, however poor, but has his horſe—tame Arabian horſes, ſome valued at a thouſand ducats, 349—different claſſes among the Arabians—they know the race of a horſe by his appearance—Arabians preſerve the pedigree of their horſes with care, for ſeveral ages, 350—countries into which the race of their horſes has ſpread itſelf, 354—they take the wild horſes with traps—the young horſe conſidered by them as a great delicacy; they feaſt upon him while any part is remaining—the uſual manner of trying the ſwiftneſs of Arabian horſes, by hunting the oſtrich; and a horſe of the firſt ſpeed is able to outrun it, 348

—treat their horſes gently—hold a diſcourſe with them —written atteſtations given to perſons who buy Arabian horſes, 351—they ſtand ſtock ſtill in the midſt of their career, the rider happening to fall, 352—keep them ſaddled at their tents, from morning to night, to prevent ſurprize—when the Arabians begin to break their horſes, 353—how the Arabians dreſs and feed their horſes, 352—firſt began the management of horſes in the time of ſheque Iſmael, 349—the rapidity of the flight of Arabian horſes is ſuch, that the dogs give up the purſuit, 347—upon computation, the ſpeed of the Engliſh horſes is one fourth greater, carrying a rider, than that of the ſwifteſt barb without one, 355—Numidian race much degenerated—the Tingitanians and Egyptians have the fame of rearing the fineſt horſes for ſize and beauty, 356—horſes of Barbary—an Italian peculiar ſport, in which horſes of this breed run againſt each other, 354—Spaniſh gennette deſcribed, 356—thoſe of Andaluſia paſs for the beſt, and preferred as war horſes to thoſe of every other country—Italian horſes have a particular aptitude to prance, 357—the horſes of *India* weak and waſhy, 362—fed with peas, ſugar, and butter—one brought to England not much larger than a common maſtiff—climates exceſſively hot ſeem unfavourable to horſes — remarkable ſports on horſeback—the horſes of the Gold Coaſt and Guinea extremely little, but very manageable, 363, 364—of *China*, weak, little, ill-ſhaped, and cowardly—thoſe of *Corea* ſo timorous, as not to be ſerviceable in war—*Tartar* horſes very ſerviceable in war; they were properly the conquerors of China, 364—march two or three days without ſtopping—continue five or ſix, without eating more than a handful of graſs at every eight hours; and remain without drinking four and twenty hours—loſe all their ſtrength when brought into China or the Indies; thrive pretty well in Perſia and Turky, 365—ancient opinions on the nature and qualities of the horſes of Theſſaly, Achaia, Ethiopia, Arabia, Afric, Italy, and particularly of Apulia, of Sicily, Cappadocia, Syria, Armenia, Media, Perſia, of Sardinia and Corſica, of Spain, Walachia, Tranſylvania, of Denmark, Scandinavia, Flanders, of the Gauliſh horſes, of the

German, Swiſs, Hungarian, and, laſtly, of the Indian horſes, 365, 366—*Daniſh* horſes of ſuch excellent ſize, and ſtrong make, that they are preferred to all others for draught, 357—ſome ſtreaked like the tyger, or mottled like the leopard—*German* and *Hungarian* horſes—*Dutch* horſes are good for draught; the beſt come from the province of Friezeland—the *Flanders* horſes—few *French* horſes good, 358—in general are heavy ſhouldered—the beſt of that country come from Limoſin, and Normandy furniſhes the next—*American* tame horſes admirable, 359—method of hunting with them, 360—iſlands of the Archipelago have very good horſes—thoſe of Crete were in great reputation among the ancients; at preſent little uſed in the country itſelf, becauſe of the unevenneſs of the ground—the original horſes of *Morocco* ſmaller than the Arabian breed—in Turky there are horſes of all races—*Perſian* horſes, in general, the moſt beautiful and moſt valuable of all the Eaſt, 361—ſome greatly eſteemed in the Ukraine, in Walachia, Poland, and Sweden, 365—with buſhy tails, and manes down to the ground, 366—*Engliſh* horſes excel the Arabian in ſize and ſwiftneſs; are more durable than the barb, and more hardy than the Perſian—one inſtance of their great rapidity, in the admirable Childers, frequently known to move above eighty-two feet and a half in a ſecond, 367, 368—fault of our manner of breaking horſes—the French managed horſe never falls before, but more uſually on one ſide—the Engliſh are for ſpeed and diſpatch, the French, and other nations, are more for parade and ſpirit, 368—Engliſh hunters conſidered the nobleſt and the moſt uſeful horſes in the world—Roger de Belegme, the firſt recorded to have attempted mending our native breed, 369—number of horſes in London, in the time of king Stephen, ſaid to have amounted to twenty thouſand—in the times of queen Elizabeth, the kingdom could not ſupply two thouſand horſes to form the cavalry—Powiſland, in Wales, for many ages famous for a ſwift and generous race of horſes, and why, 370—perfections which a horſe ought to have, according to Camerarius, 372, 373—a ruminating animal, iii. 5—in a courſe of years impoveriſh the ground, 10—the horſe and the aſs differ not ſo much in form as the cow and the biſon, yet the former are diſtinct animals, and the latter animals of the ſame kind, 15—eats two hundred and ſixty-two plants, and rejects two hundred and twelve, 176—famiſhed horſes more hairy than thoſe fed plentifully, 355—for hunting lions, muſt be of that ſort called charoſſi; all others fly at the ſight of the lion, 226—are killed by wild aſſes, ii. 380—deſtroyed by the American bat, called vampyre, in South America, iv. 145

Horſe (ſea) deſcribed, vi. 284

Hortenſius, the orator, the firſt who had peacocks ſerved up at an entertainment in Rome, v. 173

Hoſpitals erected in India, for the maintenance of all kinds of vermin, ii. 225—for monkies, erected by the Bramins, iv. 234

Hottentots, outſtrip lions in the chace, as travellers report, ii. 114—make much and very extraordinary uſe of the biſon, iii. 21, 22

Hound, *harrier*, and *beagle*, all of the ſame kind—*grey-matin* hound, tranſported to the North, becomes a great Daniſh dog; and this, ſent into the South, becomes a grey-hound of different ſizes; and the ſame, tranſported into Ireland, the Ukraine, Tartary, Epirus, and Albania, becomes the great wolf-dog, known by the name of the *Iriſh wolf-dog*—the *blood-hound*, a dog of the generous kind—and likewiſe the *gaze-hound*, and the *grey-hound*—the blood-hound a dog of great uſe, and in high eſteem among our anceſtors—its employ—the gaze-hound hunted, like our grey-hound, by the eye, not by the ſcent, iii. 283, 287

Grey-hound-fox, the largeſt, talleſt, and boldeſt of the kind, iii. 332

Howlet, a kind of owl without horns, v. 141

Hudſon's-Bay, above twelve thouſand martins ſkins annually imported from thence into England, iii. 372

Huers, name given to the men employed to give ſignals where to extend the nets in the pilchard fiſhery, vi. 327

Hughes. See *Polypus*, viii. 191

Hull, had the honour of firſt attempting that profitable brance of trade, the whale-fiſhery, vi. 201

Humber, a new iſland formed at the mouth of this riv —it is about nine miles in circumference, and worth to th proprietor about eight hundred pounds a year, i. 132

Humming-bird, is the ſmalleſt of birds, and ſeem nearly allied to the inſect, v. 40—belongs to the ſpar row-kind, 314—the ſmalleſt of them about the ſize o a hazel-nut—its deſcription—the larger humming-bir is near half as big as the common wren—its deſcriptio —are ſeen fluttering about the flowers, without eve lighting upon them—their wings in ſuch rapid motion it is impoſſible to diſcern their colours, except by thei glittering—but only extracting the honey as with a ki —their neſts and the number of eggs—their time of incubation—inſtance of their docility—countries wher found—in the Leeward Iſlands, they continue in a torpi ſtate during the ſeverity of winter—Labat aſſerts, tha beſide the humming noiſe produced by their wings, the have a pleaſing melancholy melody in their voices, ſmal and proportioned to their organs—the Indians made uſ of this pretty bird's plumage—in what manner th children take them—when taken, they are inſtantl killed, and hung up in the chimney to dry; ſome dr them in ſtoves—at preſent the bird is taken rather fo ſelling as a curioſity to Europeans, than an ornamen for themſelves, v. 356 to 361

Hump of the biſon of different ſizes, weighing from forty to fifty pounds, ſometimes leſs—cuts and taſte like a dreſſed udder, iii. 23—in a few generations i wears away, 24

Hunger, every animal endures the wants of ſlee and hunger with leſs injury to health than man—hunger kills man ſooner than watchfulneſs—more dreadful in its approaches than continuance—dreadful effects of hunger, related to the author by the captain of a ſhip, who was one of ſix that endured it in its extremities—different opinions concerning the cauſe of hunger—few inſtances of men dying, except at ſea, of abſolute hunger—thoſe men whoſe every day may be conſidered as an happy eſcape from famine, at laſt die of a diſorder cauſed by hunger—the number of ſuch as die in London of hunger ſuppoſed not leſs than two thouſand in a year—method of palliating hunger among the

American Indians, ii. 124 to 133—inſtances of amazing patience in hunger, 217

Hunters, the Engliſh conſidered as the nobleſt and the moſt uſeful horſes in the world, ii. 369—terms uſed by hunters in purſuing the ſtag, iii. 113—names invented by them for the ſtag, 113—for the fallow deer, 128

Hunting, the natural right of hunting made royal, and when, iii. 109—the ſtag and the buck performed in the ſame manner in England, and how, 112, 116—ancient manner of hunting the ſtag, 119—the manner in Sicily, 120—and in China, 122—the wolf, 318, 319—wolves uſed in hunting, 321—hunting of the fox, 328—hunting the ſable chiefly the lot of the exiles in Siberia, 375—the ouran-outang, or wild man, in Borneo, iv. 200—a favourite amuſement of the king, 200—of the elephant at the Cape of Good Hope, 280—the method uſed to take it alive, 271, 272—manner of hunting the oſtrich by the Arabians, v. 59, 60—and by the Struthophagi, 61—manner of hunting the turkey, 179

Hurco, (Aufidius) charged by Pliny with being the firſt who fatted peacocks for the feaſts of the luxurious, v. 172

Hurricane, the cloud preceding a hurricane, called by ſailors, bull's eye, deſcribed, i. 359—houſes, made of timber, bend to the blaſt of the hurricane like oſiers, and recover their rectitude—hurricanes offenſive to the ſenſe of ſmelling—maggots brought with them—common in all tropical climates; on the coaſts of Guinea, frequently three or four in a day, 360—their ſeaſons upon thoſe coaſts, at Loango and the oppoſite coaſt of Africa, 361—the hurricane called tornado, its dreadful effects, 361, et ſeq.

Hus, in Greek ſignifies a ſow, and *houina* derives from it, iii. 342, 343

Huſo, the iſinglaſs fiſh, caught in great quantities in the Danube, from October to January—furniſhes the commodity called iſinglaſs—often above four hundred pounds weight—its fleſh ſalted is better taſted, and turned red like ſalmon, vi. 278

Hyæna, no words give an idea adequate to this animal's figure, deformity, and fierceneſs—more ſavage and untameable than any quadrupede—its deſcription—defends itſelf againſt the lion, is a match for the panther, and attacks the ounce, which it ſeldom fails to conquer—an obſcene and ſolitary animal—its firſt howl ſometimes miſtaken for the voice of a man a-moaning—its latter like the violent efforts of reathing—whence it firſt took its name—native of the torrid zone, reſides in the caverns of mountains, the clefts of rocks, or dens it has formed under earth—taken ever ſo young, it never can be tamed—ſometimes attacks man, and carries off cattle—its eyes ſhine by night; and it is aſſerted that it ſees better by night than by day—ſcrapes up graves, and devours dead bodies, how putrid ſoever—abſurdities of the ancients about this animal, iii. 341 to 345

I.

Jabiru, and *jabiru* and *jabira guacu*, birds of the crane kind, natives of Braſil—their deſcriptions, v. 389

Jackalls, hunt in a pack, and encourage each other by mutual cries—what has given riſe to the report of its being the lion's provider, ii. 322—travellers have miſtaken the jackall for the fox—one of the commoneſt wild animals in the Eaſt; yet ſcarce any leſs known in Europe; or leſs diſtinctly deſcribed by natural hiſtorians—its deſcription—its cry a lamentation reſembling that of human diſtreſs—is more noiſy in its purſuits than the dog, more voracious than the wolf—never goes alone, but always in a pack of forty or fifty together—ſeems little afraid of man; purſues its game to the doors, without apprehenſion—enters inſolently into ſheep-folds, yards, and ſtables, and finding nothing elſe, devours leather harneſſes, boots, and ſhoes—ſcratches up new made graves, and devours the corpſe, how putrid ſoever—the corpſe how dug up—follows armies, and keeps in the rear of caravans—the moſt putrid ſubſtances it greedily devours—hides in holes by day, and appears abroad at night-fall—hunts by the ſcent—irreconcileable antipathy between it and the dog—no wonder it be voracious, and why—is as ſtupid as impudent—inſtance of it—Indian peaſants often chace it as we do foxes, iii. 333 to 339

Jack-daw, its deſcription, v. 230—rings found in the neſt of a tame jack-daw, v. 222

Jacobines, a kind of pigeons, v. 293

Jaculus, the ſwifteſt ſerpent, its manner of progreſſion by coiling, vii. 182

Jaguar, or the panther of America, iii. 252, 253

James, the hermit, ſaid to have lived an hundred and four years, ii. 132

Japaneſe, deſcription of that people, ii. 222

Jaw, the upper, thought by many quite immoveable; that it moves in man, an eaſy experiment will evince—has its proper muſcles behind the head for thus raiſing and depreſſing it—under jaw in the embryo much advanced before the upper; in the adult it hangs more backward—and in a Chineſe face it falls ſtill more backward than with us; the difference is thought half an inch, the mouth being ſhut naturally—a profeſſor at Edinburgh was ſubject to have his jaw diſlocated—the under jaw has often an involuntary quivering motion; and often a ſtate of langour produces another, that of yawning, a very ſympathetic kind of languid motion, ii. 92—ridiculous inſtance of this ſympathetic affection commonly practiſed upon the famous M‘Laurin, ii. 90 to 92

Jay, one of the moſt beautiful of the Britiſh birds—its deſcription—feeds upon fruits, kills ſmall birds, and is extremely docile, v. 241, 242—lays its eggs in the holes deſerted by the wood-pecker, 253

Ibex, a native of the Alps, the Pyrenees, and the mountains of Greece—its deſcription, iii. 62

Ibis, the Egyptians paid divine honours to this bird, v. 384—different opinions concerning the ancient and modern ibis—Maillet's obſervations to this purpoſe—the true ibis thought a bird of the vulture kind, called by ſome the capon of Pharoah, 385

Ice, very elaſtic, i. 180—floats of it diffuſed into plains of above two hundred leagues in length—and mountains of it riſing amidſt them—flat ice, and mountain ice, 243—their formation, 244—mountains of it preſenting the reſemblance of a glory, 245

Ichneumon, by ſome injudiciouſly denominated the cat of Pharoah, one of the boldeſt and moſt uſeful animals of the weaſel-kind—uſed in Egypt for the ſame purpoſes as cats in Europe—deſcription—diſcovers and deſtroys the eggs of the crocodile—ſerpents its moſt natural food—grows faſt and dies ſoon—eaſily ſtrangles a cat ſtronger and larger than itſelf—countries where found—attacks every living thing it is able to overcome, and fears not the force of the dog, nor the claws of the vulture—takes the water like an otter, and will continue under much longer—not able to ſupport the rigour of our winters—one from the iſland of Ceylon climbed up the walls and the trees with very great eaſe—this animal one of thoſe formerly worſhipped by the Egyptians, iii. 376 to 380

Ichneumon fly, its weapon of defence—flies of this tribe owe their birth to the deſtruction of ſome other inſect, within whoſe body they have been depoſited, and upon whoſe vitals they have preyed, till they came to maturity—of all others the moſt formidable to inſects of various kinds—it makes the body of the caterpillar the place for depoſiting its eggs—the tribe is not the caterpillar's offspring, as was ſuppoſed, but its murderers—deſcription—whence its name—fears not the waſp, and plunders its habitations,—various appetites of the various kinds of this fly—the millions of inſects this fly kills in a ſummer inconceivable, viii. 111 to 114

Ichneumon, a root the Indians believe an antidote for the bite of the aſp or the viper, iii. 377

Idra, the deplorable infirmities of the workmen in the quickſilver mines near it, i. 79

Jean-le-Blanc, a kind of eagle—its diſtinctive marks, v. 98

Jeniſca, in Tartary, a river, i. 210—receives above ſixty leſſer rivers, 217

Jenkins, a peaſant, lived to an hundred and ſixty-five years, without much regularity, ii. 201

Jeſter, in England, as late as the times of king James I. the court was furniſhed with a jeſter, ii. 251

Jevraſka, name given to the marmout in Siberia, iv. 48

Jewels, the richeſt jewels found in an Æthiop's ear, a proverb, ii. 98

Ignis fatuus, or *wandering fire*, i. 379

Iguana, deſcription of this animal—its fleſh the greateſt delicacy of Africa and America—its food—in what manner it is taken, vii. 149 to 151

Jiboya, the Great, of Java and Braſil, the dimenſions of this ſerpent, vii. 225

Ilex, the berry-bearing ilex, viii. 143

Imagination by day, as well as by night, always employed, ii. 143—very remarkable inſtance of its power in women, 245, 246

Impaling, in ſome courts of the more barbarous princes of India, they employ the elephant to impale the criminals on its enormous tuſks, iv. 279

Impregnation, the hare, though already impregnated, admits the male, and receives a ſecond impregnation, iv. 6.—in what manner the ſea and garden ſnails impregnate each other reſpectively, vii. 22, 30, 31—the bivalve ſhell-fiſh require no aſſiſtance from each other towards impregnation, 41—frogs impregnated without any apparent inſtruments of generation, an object of enquiry; continues in great obſcurity—experiments made to this purpoſe, 78, 79

Incas, father Acoſta, and Garcilaſſo de la Vega, have ſeen the bodies of ſeveral incas perfectly preſerved from corruption, ii. 273

India (Eaſt) in the warm countries of India, the women are marriageable at nine or ten, and the men at twelve or thirteen, ii. 71—deſcription of the iſlands that lie ſcattered in the Indian ocean, 223—over all India, children arrive ſooner at maturity, than in Europe—they often marry, and conſummate, the huſband at ten years old, and the wife at eight, and frequently have children at that age, 224—Indians have long been remarkable for cowardice and effeminacy—they may be conſidered as a feeble race of ſenſualiſts—their dreſs, 225—the horſes of India are weak and waſhy, 362—lions are found to diminiſh in their numbers in this country, iii. 215—the Indians eagerly purſue the porcupine, in order to make embroidery of its quills, and to eat its fleſh, iv 112—they eat bats in the Eaſt Indies, 141—See *Elephant*, iv. 278, 279

India (Weſt) whence originally comes the flat heads of the American Indians, ii. 239

Indus, river, its courſe, i. 212—its water, and that of the Thames, the moſt light and wholſome in the world, 170—the tide at the mouth of this river the greateſt known, 257

Infants juſt born, may be ſaid to come from one element into another; and why—open their eyes the inſtant of their birth—more capable of ſuſtaining hunger, and more patient of cold than grown perſons; and why—infants have milk in their own breaſts—their life very precarious, till the age of three or four—inſtances of it—the comparative progreſs of the underſtanding greater in infants, than in children of three or four years old, ii. 53 to 61

Inundations generally greater towards the ſource of rivers, than farther down; and why, i. 207—ſome diſtribute health and plenty—others cauſe diſeaſes, famine, and death, 218—every inundation of the ſea attended wirh ſome correſpondent dereliction of another ſhore—one of the moſt conſiderable in hiſtory, is that which happened in the reign of Henry I.—an inundation in the territory of Dort, deſtroyed an hundred thouſand perſons—and yet a greater number round the Dullart—remarkable inundations in Friezland and Zealand, in which more than three hundred villages were overwhelmed—their remains continue viſible at the bottom of the water in a clear day, 278—ſome in which the ſea has overflowed the country, and afterwards retired, 279—inundation of the Thames at Dagenham, in Eſſex, 283—inſtantly produced by land ſpouts, 395

Inſects, in the internal parts of South America, and Africa, they grow to a prodigious ſize; and why—thoſe of the minute kind in the northern climates not half ſo large as in the temperate zone, ii. 6—the ocean has its inſects—their feet are placed upon their backs, and almoſt all without eyes, 7—in ſome countries almoſt darken the air, and a candle cannot be lighted, without their inſtantly flying upon it, and putting out the flame, 12, and viii. 158—many may be ſupplied by being cut in pieces, ii. 23—many of the tribes brought forth from the egg, 27—have no eye-lids whatſoever, 85—the Indians are fearful of killing the meaneſt, 225—quickly brought to change, and adapt themſelves to the climate, 312—have their ſtomachs compoſed of muſcular fibres—of a ruminating kind, iii. 6—afford ſo great a variety, as to elude the ſearch of the moſt inquiſitive purſuer, v. 3—thoſe with the greateſt number of legs move the ſloweſt, vii. 63—the general definition of inſects—the different claſſes—general characteriſtics of inſects without wings, vii. 239 to 246—of thoſe that have wings, 315—ſome continue under the form of an aurelia not ten days; ſome twenty; ſome ſeveral months, and even for a year, viii. 26—general rule, that the female is larger than the male, 39—every inſect that lives a year after its full growth, is obliged to paſs four or five months without nouriſhment, and will ſeem to be dead all that time, 125—deſcription of that which forms and reſides in the gall-nut, 148

Inſtinct of animals in chuſing the proper times of copulation, ii. 337—the Guinea pig has not that natural inſtinct ſo common to almoſt every other creature, iv. 57

Inteſtines, in all animals the ſize of the inteſtines proportioned to the nature of the food, ii. 318—inteſtines of ruminating animals enlarged by nature, to take in a greater ſupply—thoſe of the carnivorous kind are ſhort, iii. 2—alſo thin and lean, but of the ruminating are ſtrong, fleſhy, and covered with fat, 4—of ſheep found to be thirty times the length of the body, iii. 209—thoſe of the wild cat not above three times the length of its body, 210—this ſhortneſs ſtill unaccounted for, 211—of the rein-deer waſhed like our tripe, in high eſteem among the Laplanders, 167—of the bat, in ſome meaſure reſemble thoſe of man, iv. 135—thoſe of the manati longer, in proportion, than thoſe of any other creature, the horſe excepted, 185—the tribe of wood-peckers want that inteſtine, called the cæcum, v. 249—the lamprey ſeems to have but one, vi. 268—thoſe of the crab have many convolutions, 362

Johndory, Quin noted for a ſauce for this fiſh, vi. 178

Joints, hair in its growth ſends forth branches at the joints, ii. 87

Jonelin, has obliged the curious with the firſt accurate deſcription of the form and nature of the ſable, iii. 373

Ireland not infeſted with wolves, iii. 319—frogs deſignedly introduced into that kingdom ſome years before the Norway rat, iv. 66—that rat put a ſtop to their encreaſe, and the frog is once more almoſt extinct in that kingdom, 67—the mole utterly a ſtranger there, 91

Iron extracted from all the ſubſtances upon earth, i. 74

Iſatis, an animal very common in all northern countries bordering upon the icy ſea, and ſeldom found in warm climates—deſcription—burrows like the fox, and when with young, the female retires to her kennel, in the ſame manner as the fox—its kennel very narrow, and extremely deep, has many out-lets—manner of coupling, time of geſtation, and number of young, all ſimilar to what is found in the fox—brings forth at the end of May, or the beginning of June—conſidered as between the dog and the fox—changes its colour, and is at one time brown, at another white—time in which it is called the *croſt-fox*, iii. 339 to 341

Iſinglaſs ſerviceable in medicine, and many arts, vi.—manner of making it—principally furniſhed from Ruſſia, where great quantities are prepared ſurpriſingly cheap—Mr. Jackſon found out a method of making a glue that anſwered the purpoſes of iſinglaſs, vi. 278, 279

Iſlands, new formed, in two ways—thirteen iſlands in the Mediterranean appearing at once emerging from the water—one new-formed in the year 1720 near that of Tercera—formed at the mouths of many rivers, and how, a beautiful and large one formed at the mouth of the river Nanquin in China, not leſs than ſixty miles long, and about twenty broad, i. 125, 131—appear, at firſt, infinitely greater than they naturally are, 388—ſeem to travel to the ſhore, and repreſent curious figures, ſhips with ſails, ſtreamers, and flags; antique elevated caſtles, and at length vaniſh into nothing, 388

Iſmael, ſheque, in his time the Arabians firſt began the management of horſes, ii. 349

Iſpahan, the prince's meſſengers go on foot thirty-ſix leagues in fourteen hours, ii. 114

Italy, the horſes there have a particular aptitude to prance, ii. 357

Jucatan, a peninſula in the gulph of Mexico, formerly a part of the ſea, i. 276

Juda-goat common in Guinea, Angola, and all along the coaſts of Africa, not much larger than a hare, iii. 59

Jugular fiſh, name given to that fiſh which has the ventral fins placed more forward than the pectoral, vi. 297

Julian's Bay (St.) an American harbour, forty-nine degrees ſouth of the line—Ferdinand Magellan happened to winter in it, ii. 260

Juniper, its ſhade was fatal, if we credit the ancients, i. 326—the Laplanders drink water, in which theſe berries have been infuſed, ii. 216

Ivory, the tuſks of the babyroueſſa are a very fine ivory, ſmoother and whiter than that of the elephant, but not ſo hard or ſerviceable, iii. 194—that of the morſe more eſteemed than that of the elephant, being whiter and harder, iv. 182—almoſt all our ivory comes from Africa, where the greateſt part is found in the foreſts, 281—the tuſks of the mammouth converted to the purpoſes of ivory, 282—teeth of the narwhal far ſurpaſs ivory in all its qualities, vi. 208

Juſtinian, the emperor, till his time the ſea was open to all nations, i. 232

Ivy-berries, ſhower of them raiſed by tempeſts in one country, and falling in another, i. 390

K.

Kaboſſu, or cataphractus, one of the largeſt kinds of the armadilla, iv. 133

Kamſkatka, deſcription of its natives, ii. 213

Kanguroo, an animal firſt diſcovered and deſcribed by Mr. Banks, iv. 350, et ſeq.

Keratophites, among the coraline fungi, viii. 197

Kermes, an inſect of great uſe in medicine and dying—its deſcription — the differences of the male from the female — the harveſt of the kermes greater or leſs in proportion to the ſeverity of the winter—women gather them before ſun-riſing, tearing them off with their nails, viii. 143, 144

Keſtril, a bird of the generous breed of hawks, v. 122

Kevel, name of a ſecond variety of gazelles made by Mr. Buffon, iii. 73

I N D E X.

Kilda (St.) a rocky iſland—its ſhores to the Weſt fix hundred fathom perpendicular above the ſurface of the ſea, i. 272—the inhabitants conſume annually near twenty-three thouſand young gannets, and a great quantity of their eggs, vi. 71—its rocks more than three quarters of a mile high, 76

Killer, a cetaceous animal of ſurpriſing ſtrength, which attacks the whale, vi. 200

Kinds of animals not actually diſtinguiſhed by horns, colour, poſition of the ears, or fineneſs of hair, iii. 60—difficult to fix preciſe boundaries between the goat-kind, and the deer, 70—the gazelles form a diſtinct kind, 71—all of the deer kind have no gall-bladder, 94

Kine, in Iceland are without horns, iii. 19

King-fiſher, a remarkable bird—its deſcription—places it frequents, and how it takes its prey—the plumage a beautiful variety of brilliant colours—inſtances of credulity with reſpect to this bird—its neſt, or rather hole, very different from that deſcribed by the ancients—feeds upon fiſh in that hole—fœtid from the remains of fiſh—the king-fiſher is found with from five to nine eggs, which the female continues to hatch—though diſturbed and robbed, ſhe returns, and lays again—Reaumur's account of this—ſeaſon for excluding the brood—the male, faithful beyond the turtle, brings the female large proviſions of fiſh, und keeps her plump and fat—he uſed to twitter before, now enters the neſt quietly and privately—the young hatched in twenty days—differ in their ſize and beauty, vi. 138 to 144

King-fiſher, the *Halcyon*—Cicero has written a long poem in praiſe of this bird, of which but two lines remain—the emperor Gordian has alſo written a poem on it, nothing of which is left—St. Ambroſe's credulity concerning this bird—fables the modern vulgar have of it—its fleſh unfit to be eaten, and its beautiful plumage preſerves its luſtre longer than any other, vi. 140 to 144

Kircher, his calculations of the heights of the mountains are incredible, and why, i. 154—has ſet the voices of birds to muſic, v. 143

Kite, from the greateſt height darts down on its prey with unerring aim, v. 10—one of the baſer race of hawks, 119—diſtinguiſhed by its forky tail, and ſlow floating motion, 129—ſeems ever upon the wing, and to make no effort in flying—lives upon accidental carnage, every bird in the air being able to make its retreat from it—ſmall birds wounded, or ſtraying chickens, it ſeizes with rapacity, 129, 130—uſed for training falcons, and how lured with the great horned owl, when caught for that purpoſe, 146, 147

Kitten, of all young animals, none more prettily playful, iii. 202

Klein, his method of claſſing animals, ii. 296

Knobber, name of the ſtag the ſecond year, iii. 113

Knot, ſmall bird of the crane kind, vi. 22—a bird of paſſage, 27

Kob, the name of the ſixth variety of gazelles by Mr. Buffon, iii. 74

Koba, the name of the fifth variety of gazelles by Mr. Buffon, iii. 74

Kraken, all that has been ſaid of this great fiſh ſeems fictitious, yet there is a poſſibility of its exiſtence, vi. 189

Krantz's account of the origin and formation of the ice-mountains in Greenland, i. 246

L.

Labrus, the wraſſe, deſcription of this fiſh, vi. 301

Labyrinth of Candia, a ſubterranean wonder, ſuppoſed the work of art, i. 63

Labyrinth, convolutions in the wind-pipe and lungs of ſome birds, v. 13

Lama, the camel of the new world—countries where found—their fleſh an excellent food—their hair, or rather wool, ſpun into beautiful cloathing—carry their burdens over precipices and craggy rocks, where men can ſcarce accompany them—deſcription and age—manner of coupling—its food—exceeds the camel in temperance—requires little water, being ſupplied with quantities of ſaliva, the only offenſive weapon it has to teſtify its reſentment—the Indians ſay, where this ſaliva falls, it will, from its acrimonious nature, burn the ſkin, or cauſe dangerous eruptions—colour and wool

—habits and marks of agility in the ſtate of nature—ſeems the largeſt of the camel kind in America—the natives hunt the wild lama for its fleece—a ſmaller, weaker ſort of the camel-kind, called alſo guanacoe and paco—the manufacture of ſtuffs, carpets, and quilts, made of the wool of the paco, form a conſiderable branch of commerce in South America, and might uſefully be extended to Europe, iv. 312 to 317

Lambs, how to be produced all the year round, ii. 338—the third an ewe brings forth ſuppoſed the beſt, iii. 45

Lamprey, a fiſh every way reſembling the lamprey, was poſſeſſed of the numbing quality of the torpedo—people will not venture to touch thoſe of Ireland—a ſpecies very different from ours ſerved up as a delicacy among the modern Romans—doubtful whether it be the murena of the ancients, which our lamprey is not—ours differently eſtimated, according to the ſeaſon—thoſe of the river Severn the moſt delicate of all fiſh—deſcription of the fiſh—extraordinary power of adhering to ſtones—inſtance of it—Muralto, giving the anatomy of this fiſh, makes no mention of the lungs, for which it has abſolute neceſſity to breathe in the air—its time of leaving the ſea annually, in order to ſpawn, is the beginning of ſpring—after a few months, it returns to the ſea—peculiar preparation for ſpawning—the young from eggs—the female remains at the place where produced—they are excluded till they come forth—has her family playing about her, and conducts them in triumph to the ocean—its food—ſome continue in freſh water till they die—a ſingle brood the extent of the female's fertility, two years being the limit of her exiſtence—beſt ſeaſon for them the months of March, April, and May—are uſually taken in nets with ſalmon; ſometimes in baſkets at the bottom of the river—old cuſtom for the city of Glouceſter annually to preſent the king with a lamprey pye—a ſenator of Rome uſed to throw into his ponds ſuch of his ſlaves as diſpleaſed him, to feed the lampreys, vi. 263 to 270

Lands, new, produced from the ſea, and in what manner, i. 277

Lanner, bird of the generous breed of hawks, now little known in Europe, v. 121

Lapland, its diviſion, iii. 153—mountains there preferred to the woods—the country abounds more than others with marſhy bottoms and weedy lakes—gnats and gad-flies formidable there, 155, 157—the manner of travelling in it, 162—Laplanders caſtrate the rein-deer with their teeth, 163—the wolf never attacks a rein-deer that is haltered, and why, 321—the iſatis found in this country, 340—in the foreſts, ſquirrels obſerved to change their habitation; they remove in numbers from one country to another, iv. 32

Laplanders, one of the firſt diſtinct race of men round the polar regions—deſcriptions of their perſons and manners—have in every family a drum for conſulting the devil—Guſtavus Adolphus attempted in vain to form a regiment of Laplanders—uſe ſkates to run and ſlide, and how—are all hunters—offer their wives and daughters to ſtrangers, ii. 213 to 218—wants ſupplied and riches derived from the rein-deer, iii. 149, 155, 166, 167—manner of life, 154—boil milk with wood-ſorrel, and keep it in caſks under ground, to be eaten in winter, 166—when the lemins draw up to fight, they form ominous prognoſtics from their arrangement, iv. 88—happy when an army of lemins comes down among them; they then feaſt upon their fleſh, which dogs and cats deteſt, 90

Lapwing, a ſmall bird of the crane kind, vi. 22—its arts to lead off men and dogs from their neſts, 31—their ſeaſons of courtſhip, 30

Lark, bird of the ſparrow kind, v. 314--the ſky, the wood, or the tit-lark, diſtinguiſhable from other little birds, by length of heel and loud ſong, 333—neſt, number of eggs, and habits, 334—thoſe that remain with us the year throughout, are birds of paſſage in Sweden, 318

Lark (ſea) a ſmall bird of the crane kind, vi. 22—breeds in this country, 28

Lava, matter diſcharged by the eruptions of volcanos, i. 103

Laughter, in what manner produced, ii. 92

Launce, deſcription of this fiſh, vi. 305

Lauricocha, a lake wherein the river Amazons has its ſource, i. 215

Lawrence, (St.) a river—its riſe and courſe, i. 216—receives about forty rivers, 218—its cataract, 223

Laws, one in the Orkney Iſlands, entitling any perſon that kills an eagle to a hen from every houſe in the pariſh where killed, v. 92

Layer, the impreſſion on the place where the ſtag has lain, iii. 114

Layers of the earth regularly diſpoſed, but not of the ſame kind in every place—enumeration of layers of earth in a well dug at Amſterdam, and of another dug at Marly—a layer, as far as it extends, always maintains the ſame thickneſs—proceeding to conſiderable depths, every layer is thicker—are ſometimes very extenſive, and often found to ſpread over a ſpace of ſome leagues in circumference, i. 56 to 58—remarkable layers of earth round the city of Modena, 282

Lead-mine, one in Flintſhire, iv. 282

Leather called chamois, made of the ſkin of that animal, and alſo from thoſe of the tame goat, the ſheep, and the deer, iii. 69

Leather harneſs devoured by the jackall, iii. 335

Leaves, two of a fig-tree, by experiment, imbibed from the earth two ounces of water in five hours and a half, i. 195

Leech, different kinds—its deſcription—takes a large quantity of food—has no anus or paſſage to eject it from the body when digeſted—in what it differs from the reſt of the reptile tribe—the leech uſed in medicine—a girl of nine years old killed by leeches—beſt way of applying leeches, vii. 306 to 311

Legs, a man without them performed aſtoniſhing feats of dexterity, iv. 250

Leming, a bold animal of the rat kind, native of Scandinavia—often pours down in myriads from the northern mountains, and, like peſtilence, deſtroys all the productions of the earth—Laplanders believe they drop from the clouds—their deſcription—they move, in a ſquare, forward by night, and lying ſtill by day—whither their motions are turned, nothing can ſtop them; a fire, a deep well, a torrent, does not turn them out of their direction—they never retreat—interrupted by a boat acroſs a river, they go over it—ſtopped by a ſtack of hay or corn, they gnaw their way through; and obſtructed by a houſe they cannot get through, continue before it till they die—eat nothing prepared for human ſubſiſtence—never enter a houſe to deſtroy proviſions—paſſing through a meadow, deſtroy it in a ſhort time, and leave it with the appearance of being burnt up, and ſtrewed over with aſhes—a man imprudently attacking one of them, the animal furiouſly flies at him, barking ſomewhat like a puppy, faſtens, and does not eaſily quit its hold—their leader forced out of the line, after a long defence, and ſeparated from the reſt, ſets up a plaintive cry, not of anger, and hangs itſelf on the fork of a tree—they deſtroy and devour each other—after incredible devaſtations, they ſeparate into armies, oppoſed with deadly hatred, and move along the coaſts of the larger lakes and rivers—the Laplanders form prognoſtics from the manner of their arrangement—what prognoſtics—the diviſions continue their engagements and animoſity until one party be overcome; then they diſappear, and it is ſuppoſed, that, having nothing to ſubſiſt on, they devour each other—their carcaſes ſometimes infect the air for miles around, and produce malignant diſorders—they ſeem alſo to infect the plants, the cattle often dying in the places where they paſſed—the male larger and more beautifully ſpotted than the female—are extremely prolific—breeding does not hinder their march, ſome carrying one young in their mouth, and another on their back—are greatly preyed upon by the ermine, and even by the rein-deer—dogs and cats deteſt their fleſh, but the Laplanders eſteem it good eating, and devour it greedily, iv. 84 to 90

Leo, the emperor, granted the nations in poſſeſſion of the ſhore the ſole right of fiſhing before their reſpective territories, i. 232

Leopard, the American is neither ſo fierce nor ſo valiant as that of Africa and Aſia, ii. 332—the large, and the leopard or panther of Senegal—differences between thoſe animals, iii. 251—leopard will not fly at the approach of the lion, 226

Lepadogaſter, deſcription of this fiſh, vi. 306

Leproſy, in what manner the Indians endeavour to prevent the Arabian leproſy, or the elephantiaſis, a diſeaſe to which man and the elephant are equally ſubject, iv. 265

Lerot, the middle dormouſe, according to Mr. Buffon, iv. 76

Leymmer, a dog of the generous kind, iii. 286, 288

Libella, the dragon-fly—general characteriſtics—eggs—food of the young—how they prepare to change from the reptile to the flying ſtate—deſcription—the ſtrongeſt and moſt courageous of all winged inſects—the buſineſs of impregnation, how performed, vii. 316 to 322

Liboya, the greateſt of the ſerpent kind, vii. 173

Lichen rangiferinus, the food of the rein-deer, a moſs in Lapland of two kinds; the white in the fields, and the black on the trees, iii. 154, 159

Lidme, name of the eleventh variety of gazelles, by Mr. Buffon, iii. 79

Life, formerly ſuppoſed producible only by oviparous and viviparous generation; but later diſcoveries induce many to doubt whether animal life may not be produced merely from putrefaction, ii. 22—the beginning of our lives, as well as the end, is marked with anguiſh, 48—that of infants very precarious, till the age of three or four—inſtances of it, 59, 60—the duration of life in general nearly the ſame in moſt countries, 202—the moſt uſeleſs and contemptible of all others, the moſt difficult to deſtroy, viii. 173

Light, the hand expoſed to broad day-light for ſome time, then immediately ſnatched into a dark room, will ſtill be luminous, and remain ſo for ſome time, and why—dangerous to the ſight to look ſteadily upon bright and luminous objects, and why—ſuch perſons as read or write for any continuance, ſhould chooſe a moderate light, ii. 159, 160

Light ſent forth by the glow-worm, how produced hitherto inexplicable, viii. 141—ſent forth by the ſtar-fiſh, reſembles that of phoſphorus, 175

Lightning is an electrical flaſh produced by the oppoſition of two clouds, i. 373—of the torrid zone, is not ſo fatal or ſo dangerous as with us, otherwiſe thoſe regions would be uninhabitable, 379—flaſhing without noiſe, illuminates the ſky all around in the torrid zone, 377, 379

Lights, northern lights illuminate half the hemiſphere, i. 377

Limbs of the inhabitants near the poles are ſometimes frozen and drop off, i. 386—ſome animals live without, and often are ſeen to reproduce them, viii. 170

Lime, manner of making it in Perſia, i. 86

Line, upon the approach of the winter months under the line, the whole horizon ſeems wrapt in a muddy cloud, i. 377—in America, all that part of the continent which lies under the line is cool and pleaſant, ii. 133—in general, as we approach the line, we find the inhabitants of each country grow browner, until the colour deepens into perfect blackneſs, 235

Linnæus, the celebrated naturaliſt, ſuppoſes man a native of the tropical climates, and only a ſojourner more to the north—argument to prove the contrary, ii. 240—his method of claſſing animals, 298. 299—makes the female of the bat a *primas*, to rank it in the ſame order with man, iv. 138

Linnet, a bird of the ſparrow kind, v. 315, 317—taught to whiſtle a long and regular tune, 345

Lion, to compare the ſtrength of the lion with that of man, it ſhould be conſidered that the claws of this animal give a falſe idea of its power, aſcribing to its force what is the effect of its arms, ii. 111—leaps twenty feet at a ſpring, 322—does not willingly attack the horſe, and only when compelled by the keeneſt hunger, 319—combats between a lion and a horſe in Italy—the lion ſtunned, and left ſprawling, the horſe eſcapes; but the lion ſucceeding, ſticks to his prey, and tears the horſe in pieces inſtantly, 319, 320—produced under the burning ſun of Africa, is the moſt terrible and moſt undaunted creature, iii. 214—deſcription of this noble animal, 219 to 222—he degenerates when removed from the torrid zone, 213—a ſingle lion of the deſert often attacks an entire caravan, 216—he crouches on his belly, and continues ſo with patient expectation, until his prey comes within a proper diſtance, 223—the female has no mane, 221—his roaring is ſo loud, that when heard in the night, and re-echoed by the mountains, it reſembles diſtant thunder, 224—attends to the call of the jackall, 337—in countries tolerably inhabited, the lion is cowardly, and often ſcared by the cries of women and children, 201

Lions, thoſe of mount Atlas have not the ſtrength or ferocity of thoſe of Bildulgerid or Zaara—ſpecies of this animal diminiſhing daily—Mr. Shaw obſerves, the Romans carried fifty times as many lions from Lybia in one year, for their amphitheatres, as are in the whole country at this time—the ſame remark made with regard to Turky, Perſia, and the Indies; where the lions diminiſh in their number daily—thoſe inhabiting the peopled countries of Morocco or India, ſcared away with a ſhout—the keepers play with him, plague, and chaſtiſe him without a cauſe; he bears it with compoſure, but his anger once excited, the conſequences are terrible—an inſtance from Labat—numberleſs accounts aſſure his anger noble, his courage magnanimous, and his natural ferocity ſeldom exerted againſt his benefactors—he has ſpared the lives of thoſe thrown to be devoured by him, afforded them part of his ſubſiſtence, and ſometimes abſtains from food himſelf to ſupport them—neceſſity alone makes him cruel—the manner of hunting them by Hottentots and others—reported that he ſuſtains hunger a long time, but thirſt he cannot ſupport — ſome believe him in a continual fever—he drinks as often as he finds water, and laps it — he requires about fifteen pounds of raw fleſh in a day—he rather hunts for a freſh ſpoil, than returns to that he had before—his breath is offenſive, and his urine inſupportable—horſes for hunting them of that ſort called charoſſi; all others fly at the ſight of him, iii 214 to 227—the lion prefers the fleſh of camels to other food—is alſo fond of that of young elephants—when old, finding men and quadrupedes together, he attacks the latter, and never meddles with men, unleſs provoked—manner of copulation, time of geſtation, number brought forth, and time taken to come to perfection, all known—a lion in the Tower of London above ſeventy years—the lioneſs fearing her retreat diſcovered, hides her tracks, by running back, or bruſhing them out with her tail—becomes terrible with young ones to provide for—lions, incited by deſire, fight bloody battles, till one becomes victorious over the reſt—the ſize of the lion between three and four feet; the female in all dimenſions about one third leſs—there are properly no lions in America; the *puma* has received the name of the *American lion*, but, when compared, is a very contemptible animal, 228 to 232.

Lion-cat, or *Angora-cat*, a beautiful animal, a native of Syria or Perſia, iii. 212

Lion, (ſea) deſcribed in Anſon's voyages, regarded as the largeſt of the ſeal family, iv. 180

Lipidopus, the garter-fiſh, its deſcription, vi. 306

Lips, thoſe of the hare and the ſquirrel continually move, whether ſleeping or waking, iv. 3

Lithophytes, and coralline ſubſtances, viii. 192

Litters, in all animals, intermediate litters moſt fruitful; firſt and laſt generally produce feweſt and weakeſt of the kind, ii. 336

Littorales, Latin name for thoſe ſhells that are caſt upon ſhore, vii. 13

Liver of a ſhark affords three or four quarts of oil, vi. 243

Lizards, along the coaſts of Guinea their fleſh eſteemed a delicacy, iii. 298—differ from every other claſs of animals, and from each other—whence the greateſt diſtinction—general characteriſtics, vii. 112 to 116—the water kind changes its ſkin every fourth or fifth day, 145—ſprinkled with ſalt, the whole body emits a viſcous liquor, and the lizard dies in three minutes, in great agonies—the whole of the kind ſuſtain the want of food in a ſurpriſing manner, 146

Lizard, *(Chalcidian)* of Aldrovandus, deſcribed, vii. 156

Lizard (flying) of Java, account of it by Gentil, vii. 157

Loach, the deſcription of this fiſh, vi. 308

Lobſter, a ruminating fiſh, iii. 5—very voracious, though without warmth in its body, or red blood in its veins—whatever it ſeizes upon, and has life, periſhes, however well defended—they devour each other, and, in ſome meaſure, eat themſelves; changing their ſhell and ſtomach every year, the old ſtomach is the firſt morſel to glut the new—at firſt ſight, the head may be miſtaken for the tail—its deſcription—the food of the young,

—the molting ſeaſon—how they change their ſhells—many die under this operation—ſpeedy growth of the new ſhell; and of itſelf after the change—the claws of unequal magnitude, and why—at certain ſeaſons they never meet without an engagement—wonders this extraordinary creature offers to imagination—are endowed with a vital principle, that furniſhes out ſuch limbs as have been cut away—varieties of this animal with differences in the claws, little in the habits or conformation—the ſhell black when taken, but turns red by boiling—common way of taking the lobſter, vi. 352 to 361

Locuſt, the great brown *locuſt* ſeen in ſeveral parts of England in 1748; in ſome ſouthern kingdoms they are ſtill formidable—deſcription of this inſect—in what manner they take the field—their devaſtations—are ſtill more noxious when dead—inſtance of it—account of their devaſtations in Ruſſia, Poland, Lithuania, and Barbary—transformations—eaten by the natives in many kingdoms of the Eaſt; and caught in ſmall nets for that purpoſe—their taſte—are conſidered as a great delicacy in Tonquin, by the rich and the poor—muſt have been a common food with the Jews—deſcription of the great *Weſt-Indian locuſt*, the moſt formidable, vii. 340 to 348

Loir, the greater dormouſe, ſo called by Mr. Buffon, iv. 76

Longevity, perſons remarkable for it, ii. 200, 201

Lorenzini, his experiments upon the torpedo, vi. 262

Lori, the longeſt of all animals, in proportion to its ſize—deſcription—a native of the iſland of Ceylon, iv. 241

Loricaria, deſcription of this fiſh, vi. 307

Lories, a kind of parrot, v. 272

Louſe, its deſcription—whether diſtinguiſhed by the parts of generation into males and females, not yet diſcovered—the louſy diſeaſe frequent among the ancients, vii. 270 to 274

Louſe (wood) the deſcription—of great uſe in medicine, vii. 286, 287

Leuwenhoeck, his opinion about the rudiments of animals, ii. 18

Luminous appearance of the waves in the night, the cauſe, i. 247, 248

Lump-fiſh, its deſcription—flung into a pail of water, will ſtick ſo cloſe to the bottom, that on taking the fiſh by the tail, the pail and ſeveral gallons of water may be lifted—their fleſh, vi. 283

Lungs, animals before birth make no uſe of their lungs, iv. 171—no anatomiſt has deſcribed the lungs of the lamprey, vi. 267—caterpillars have eighteen lungs, and live ſeveral days in the exhauſted receiver of the air-pump, viii. 14

Lybia, its inhabitants uſe oſtriches as horſes—alſo at Joar—inſtance of it at the factory of Podore, v. 62

Liboija, of Surinam, a kind of ſerpent, thirty-ſix feet long, vii. 172

Lynx, diſtinguiſhed from the ounce, and deſcribed—firſt ſtriking diſtinction between it and thoſe of the panther-kind is the tail—each hair of this animal is of three different colours—it is not above the ſize of the ounce—chiefly met with in the cold countries bordering on the pole, in the north of Germany, Lithuania, Muſcovy, Siberia, and North America—thoſe of the new continent are ſmaller than in Europe—this animal has been called *lupus cervarius*, but for what reaſon hard to gueſs—in its nature it exactly reſembles the cat, is bigger, and near two feet long, is alſo bolder and fiercer—is more delicate than the cat—reſembles the wolf in nothing, except its cry—ſeveral reports of the lynx, propagated by ignorance or impoſture, iii. 257 to 265

Lyſter, ſtrangeneſs of his theory to explain the invariable motion of winds, i. 342

M.

Macaguo, a kind of monkey deſcribed by Mr. Buffon, iv. 233

Maccaw, the large kind of parrot the ſize of a raven, v. 272

Machinel-tree, in America, its ſhade fatal, i. 326—no plant will grow under it, ii. 4

Machines, the invention of many has rendered human ſtrength leſs valuable, ii. 119

Mackarel, produces five hundred thouſand eggs, in one ſeaſon, vi. 174—deſcribed, 301—its growth, 334

Madagaſcar, its natives deſire nothing ſo ardently as to proſtitute their wives or daughters to ſtrangers, and for the moſt trifling advantages, ii. 74—the great bat of that iſland deſcribed, iv. 141, 142

Maddor. See *Blood*, ii. 194

Madneſs produced by want of ſleep, ii. 135—cured by muſic—and alſo cauſed by it. See *Henry IV*. ii. 170

Maelſtroom, Dutch name for a whirlpool, one upon the coaſt of Norway, conſidered as moſt dreadful and deſtructive—the body of water forming this whirlpool, extended in a circle of above thirteen miles, i. 267, 268

Magellan, (Ferdinand) a Portugueſe of noble extraction, firſt diſcovered the gigantic race of mankind, towards the extremity of South America—account of this diſcovery—he was ſlain upon one of the Molucca iſlands, ii. 259, 260

Magni, an Italian traveller diſcovered the remarkable grotto of Antiparos, in the Archipelago, i. 67

Maggot of Buffon, the *cynocephalus*, the laſt of the ape kind—its deſcription, iv. 207

Magpie thieviſh; rings found in the neſt of a tame magpie, v. 222—habits and food—when ſatisfied for the preſent, it lays up the remainder for another time—places where it builds and neſts deſcribed—number of eggs—in its domeſtic ſtate, preſerves its natural character ſtrictly—fooliſh cuſtom of cutting its tongue to teach it to ſpeak, puts the animal to pain, and baulks the intention, v. 238 to 241

Mahometans, conſidering the hare an unclean animal, religiouſly abſtain from its fleſh, iv. 14

Maimon, the laſt of the baboons, Edwards calls it the *pigtail*—its deſcription—native of Sumatra, does not well endure the rigours of our climate, iv. 215

Maire, (James Le) a traveller who confirms the exiſtence of giants in America, ii. 261

Maki, the laſt of the monkey-kind, iv. 188—their deſcription—many different kinds of theſe animals, iv. 238 to 241

Malabar, land and ſea breezes upon thoſe coaſts, i. 351

Mala-

Malacopterigii, the barbarous Greek name given to the ſoft-finned fiſh; the prickly-finned ſort termed *Acanthopterigii*, vi. 297

Malaballo, a very conſiderable volcano in South America, i. 99

Malebranche, grounds his beautiful theory of monſtrous productions upon a famous inſtance related by him; and ſome theory from which he deduces the effects of imagination upon the fœtus, ii. 245, 246

Malbrouk, a monkey of the ancient continent—its deſcription—the Bramins have hoſpitals for ſuch as are ſick, or diſabled, iv. 233, 234

Maldivia iſlands, have lands in them at one time covered with water, and at another free, i. 279

Mallard, a kind of duck, vi. 130—with very particular faculties for calling, 127

Malpighi, his famous experiment upon the ſtigmata of caterpillars, viii. 14

Mammouth, its tuſks, which are uſed as ivory, and ſuppoſed to belong to the elephant, often weigh four hundred pounds, iv. 282

Man, endures a greater variety of climates than the lower orders are able to do, and why, i. 319—differences in his ſpecies leſs than in animals, and rather taken from the tincture of the ſkin than variety of figure—there are not in the world above ſix diſtinct varieties in the race of men—firſt race in the polar regions, deep brown, ſhort, oddly ſhaped, ſavage—ſecond, the Tartar race, olive coloured, middle ſized, ugly, robuſt—third, the ſouthern Aſiatics, dark olive, ſlender ſhaped, ſtrait black hair, feeble—fourth, the negroes of Africa, black, ſmooth ſkin, woolly hair, well ſhaped—fiſth, the Americans, copper colour, ſtrait black hair, ſmall eyes, ſlight limbed, not ſtrong—ſixth, the Europeans and bordering nations, white of different tints, fine hair, large limbed, vigorous, ii. 212 to 231—may be called the animal of every climate, 9—intended naturally to be white, 233—white men reſemble our common parent more than the reſt of his children, 239—a native of the tropical climates, and only a ſojourner more to the north, according to Linnæus—arguments ſufficient to prove the contrary, 240—marriageable in the warm countries of India at twelve and thirteen years of age, 71—juſt come into the world gives a picture of complete imbecillity, 52—vain man ventures to excite an auditor's attention, at the riſk of incurring his diſlike, 99—as man has a ſuperiority of powers over other animals, ſo is he proportionably inferior to them in his neceſſities—nature has made him ſubject to more wants and infirmities than other creatures: but all theſe wants ſeem given to multiply the number of his enjoyments—and in what manner, 123—firſt ſenſations of a man newly brought into exiſtence, and the ſteps by which he arrives at reality pointed out by Mr. Buffon, 187—the only animal that ſupports himſelf perfectly erect—the buttock, in man, different from that in all other animals—man's feet alſo different from thoſe of other animals, the apes not excepted—the nails leſs in man than in any animal, 105—ſaid to be tall when from five feet eight inches to ſix feet high, 108—probability that men have been, in all ages, much of the ſame ſize they are at preſent—many corroborating proofs of this, 265—generally lives to ninety or a hundred years, if not cut off by diſeaſes—how men lived ſo much longer in earlier times than at preſent, 203—proportionably ſtronger for his ſize than any other animal—to compare the ſtrength of a lion with that of man, it muſt be conſidered the claws of the animal give a falſe idea of its power; and aſcribe to its force the effects of its arms—another manner of comparing the ſtrength of man with that of animals, is by the weights which either can carry, 111—Dr. Deſaguliers ſpeaks of a man able to raiſe two thouſand pounds, by diſtributing the weights in ſuch manner that every part of his body bore its ſhare, 112—exerciſed in running, outſtrips horſes; a ſtout walker, in a journey, walks down a horſe, 114—thoſe employed as meſſengers at Iſpahan in Perſia, runners by profeſſion, go thirty-ſix leagues in fourteen hours, 114—every animal endures the wants of ſleep and hunger with leſs injury to health than man, 124—he cannot, uninjured, live four days without eating, drinking, and ſleeping, 125—one ſaid to live without food for ſeven days, 132—requires ſleep for double motives, the refreſhment of the mental as well as the bodily frame, 134—more difficult for man than any other animal to procure ſleep, 136—has a lump upon the wind-pipe, not to be ſeen in woman, 102—a young man deaf and dumb from his birth, knew nothing of death, and never thought of it till the age of twenty-four, when he began to ſpeak all of a ſudden, 176—account of a man ruminating, iii. 6, 7—in thoſe countries where men are moſt barbarous and ſtupid, there brutes are moſt active and ſagacious, iv. 231—one, without hands or legs, by practice uſed his ſtumps for the moſt convenient purpoſes, and performed aſtoniſhing feats of dexterity, 250—man dies under wounds which a quadrupede or a bird could eaſily ſurvive, viii. 170

Manufactures, the woollen manufacture not carried on here till ſeveral ages after ſheep were propagated in England—unavailing efforts of our kings to introduce and preſerve it—the Flemings poſſeſſed the art in a ſuperior degree—the inhabitants of the Netherlands improved us in this art, and when—the woollen manufacture ſuppoſed for ſome time decaying amongſt us, iii. 43 to 44—of ſtuffs of the wool of the pacos, a conſiderable branch of commerce in South America, iv. 317

Manati, may indiſcriminately be the laſt of beaſts, or the firſt of fiſhes—its deſcription—the female has breaſts placed forward, like thoſe of women—the tongue ſo ſhort, ſome have pretended it has none—never entirely leaves the water, only advances the head out of the ſtream, to reach the graſs on the river ſides—it feeds entirely on vegetables—places where found—graze among turtles and other cruſtaceous fiſhes, giving or fearing no diſturbance—unmoleſted, they keep together in large companies, and ſurround their young—bring forth in autumn; and ſuppoſed to go with young eighteen months—the manati has no voice nor cry—its inteſtines are longer in proportion than thoſe of any other creature, the horſe excepted—the fat which lies under the ſkin, expoſed to the ſun, has a fine ſmell and taſte, and exceeds the fat of any ſea animal—the heat of the ſun does not make it rancid; it taſtes like the oil of ſweet almonds, and ſerves every way inſtead of butter; any quantity may be taken inwardly, having no other effect than to keep the body open—the fat of the tail, boiled, more delicate than the former—the lean takes a long time in boiling, and eats like beef—the fat of the young like pork, and the lean like veal, iv. 183 to 186

Mandril, the largeſt of the baboon kind—its deſcription—when diſpleaſed, weeps like a child—is a native of the Gold Coaſt, iv. 214

Mangabey, a monkey of the ancient continent—its deſcription, iv. 234

Mangrove-tree, that grows down in the water of the Senegal river, i. 220

Manks-Puffin, or *coulterneb*, a ſmall water-fowl—deſcribed, vi. 97 to 103

Manyfold, name of the third ſtomach of ruminating animals, iii. 4

Map of the bottom of that ſea which lies between Africa and America, given by M. Buache, i. 290

Marcaſites, their compoſition—experiment by way of proof, i. 76, 77

Mares, their exportation prohibited by a law in Arabia, ii. 353—ſtuds in Perſia of ten thouſand white mares, with hoofs ſo hard that ſhoeing is unneceſſary, 355—a law in England, prohibiting the exportation of mares and ſtallions; and one ſimilar to this obtained ſo early as the times of Athelſtan, 369

Marikina, a monkey of the ſagoin kind, with a mane round the neck, and a bunch of hair at the end of the tail, like a lion, iv. 237

Mariners, to multiply their numbers, queen Elizabeth enjoined that her ſubjects ſhould faſt from fleſh on Fridays and Saturdays, ii. 131

Marle, different ſorts found in a well dug at Marly, i. 57

Marmoſe, only differs in ſize from the oppoſſum, being leſs; inſtead of the bag to receive the young, has only two longitudinal folds, within which the premature young, continue to ſuck—when firſt produced not above the ſize of a bean; but ſtick to the teat until they arrive at maturity, iv. 247

Marmout, or *marmotte*, a ruminating animal, iii. 5—a native of the Alps—its deſcription—is eaſily tamed, readily taught to dance, weild a ſtick, and obey the voice of its maſter—it has an antipathy to the dog—

ſtrength and agility—ludicrous ſaying that the Savoyards, the only chimney-ſweepers of Paris, have learned their art from the marmotte they carry about for ſhew—is apt to gnaw the furniture—other affections of this animal—its food—is cleanly, but has a diſagreeable ſcent—ſleeps during winter—form of its hole reſembles the letter Y—manner of making it—they live together, and work in common to make their habitations ſnug and convenient—when they venture abroad, one is placed as a centinel upon a lofty rock—Mr. Buffon ſays it does not ſleep during winter, is rather in a torpor, a ſtagnation of all faculties—its heat not more than ten degrees above congelation—the fleſh ſaid to have a wild taſte, and to cauſe vomiting—countries where it is found—inhabitants of the Alps do not till winter open its hole—produces but once a year, and brings forth three or four at a time—they grow faſt, and their lives are not above nine or ten years, iv. 38 to 48

Marriage and conſummation of the Indians, the huſband at ten years old, and the wife at eight; frequently have children at that age, ii. 224

Marriotte, his experiment proves that water acts as a menſtruum upon air, i. 369

Marrow, ſpinal, and the brain, the firſt ſeen as begun in the embryo, ii. 146

Marſigli (count) his opinion upon corals and ſpunges, viii. 193

Martin, its deſcription—the moſt beautiful of all Britiſh beaſts of prey—its ſcent a pleaſing perfume—the yellow-breaſted martin—its fur more valuable than the white-breaſted ſort—Mr. Buffon ſuppoſes them a diſtinct ſpecies, that diſtinction unneceſſary—of all the weaſel-kind the moſt pleaſing, 367 to 369—feeds as they do, and is fond of honey, iii. 358—ſeldom meets the wild-cat without a combat—wild-cat not a match for the martin—kept tame by Geſner and Mr. Buffon—often ſlept for two days, and then was two or three days without ſleeping—the yellow-breaſted more common in France than England—in that retreat the female brings forth her young, three or four at a time—and they come with the eyes cloſed—how ſhe compenſates for her deficiency of milk—this animal more common in North America than in

Europe—found in all northern parts of the world, from Siberia to China, and Canada—in every country hunted for their furs, very valuable, and chiefly ſo when taken in the beginning of winter—one part of its ſkin moſt eſteemed—twelve thouſand of theſe ſkins annually imported into England from Hudſon's-bay, and thirty thouſand from Canada—ſmall birds alarm the ſpot where the dam keeps her young, and direct the hunter in his purſuit, 369 to 372—its neſt generally the tenement of the ſquirrel, taking poſſeſſion, and killing the owner—the white-breaſted keeps near houſes and villages; the yellow keeps in woods, leads a ſavage life, iv. 30—ſeizes alſo the flying ſquirrel, 36

Martin, a bird of the ſwallow tribe, v. 346

Marum, cats exceſſively fond of this plant, iii. 206

Maſtiff, one of the three deſcendants of the ſhepherd's dog, iii. 283—chiefly a native of England; when tranſported into Denmark, becomes the little Daniſh dog, 284—the Dutch maſtiff, 286

Maſtiff fox, ſecond variety of foxes, leſs than the greyhound-fox, and ſtronger than the cur-fox, iii. 332

Maturity, attained to by ſlow ſteps, announces a ſlow march to old age—as true in other animals as in man and vegetables, ii. 199—ſooner arrived at in India than in Europe, 224

Maw, in fiſhes, poſſeſſes the power of digeſting, vi. 162

Maximin, (the emperor) a prodigy of ſtrength—ſeveral inſtances of it—by birth a Thracian; from being a ſimple herdſman he roſe by the gradations of office, until he came to be emperor of Rome was above nine feet in height, and the beſt proportioned man in the empire, ii. 118—was killed by his own ſoldiers, while ſleeping, 119

May-bug, or *dorr-beetle*, deſcribed, viii. 130 to 136. See *Beetle*.

Meaſled hares, diſtinguiſhed from mountain hares, they keep in low grounds, their fleſh moiſt, white, and flabby, iv. 11, 12

Mechaniſm, which regulates the number of our years, admits no change in its laws, and can be affected only by long faſting, or great exceſs, ii. 202

Medauro, the braſs helmet dug up there fits a common man, yet is allowed to have been left there at the overthrow of Aſdrubal, ii. 265

Media, has paſtures in its plains excellent for rearing horſes, ii. 361

Medicine, many of its ſalutary purpoſes obtainable from ſome parts of the oſtrich, v. 62—alſo from many parts of quadrupedes, iii. 69

Mediterranean ſea, always receiving, and never diſcharging water, is no way fuller than before—in what manner ſome account for this, i. 263, 264—water ſpouts ſeen in it—deſcription of them by Tournefort, 390 to 393—ſolutions offered for this phenomenon by Mr. Buffon and Dr. Stewart, 393, 394—this ſea one of the ſmootheſt and moſt gentle in the world, 267

Meduſa, name given by Linnæus to a ſmall inſect, thought the ſimple food of the great Greenland whale, vi. 197—walfiſchoas, the name given to it by the Icelander, 198

Meibomius, has collected ſome few remains of ancient muſic, which do not leave room to regret what is loſt, ii. 169

Membrane, the nictitating membrane in birds—veils the eye at pleaſure, whilſt the eye-lid continues open, v. 9

Mendip mines, in Somerſetſhire, account of them by Mr. Locke, i. 77

Menſtruum, that body which is moſt fluid and penetrating, is likely to be the menſtruum of one leſs ſo—Marriotte's experiment ſhews that water will act as a menſtruum upon air, i. 369—cold diminiſhes the force of menſtruums, and often promotes evaporation, 370

Merlin, the ſmalleſt of the hawk or falcon-kind, ſcarce larger than a thruſh, diſplays a degree of courage rendering him formidable to birds far above his ſize—kills a partridge or a quail at a ſingle pounce from above, v. 122—the purſuit of the lark by a couple of merlins is a moſt delightful ſpectacle, 128

Metals, the richeſt, in their native ſtate, leſs glittering and ſplendid than uſeleſs marcaſites, i. 74, 75—thoſe trades that deal in their preparations, always unwholſome, 326—all pieces ſwallowed by animals loſe part of their weight, and often the extremities of their figure, v. 55

Meteors, between the tropics, and near the poles, aſſume dreadful and various appearances, i. 376—in thoſe countries where the ſun exerts the greateſt force in raiſing vapours, there are the greateſt quantity of meteors, 377—one of a very uncommon kind, ſeen by Ulloa, at Quito, 382

Method, the principal help in natural hiſtory; without it little progreſs made in this ſcience—the moſt applauded of claſſing animals—the author's method of claſſing them—that of deſcribing all things by words alone, a fault that has infected moſt of our dictionaries, and bodies of arts and ſciences—Mr. Locke has obſerved, that the drawing of an animal, taken from life, is the beſt method of advancing natural hiſtory, ii. 289 to 308

Mew, ſaid of ſtags when they caſt their heads, iii. 114

Mice, have burrowed in the back of hogs, while fattening in the ſty, without being felt, iii. 178—and rats cannot endure the ſcent of the genett, 388—in 1580, at Hallontide, an army of mice over-run the marſhes near Southminſter, and eat up the graſs to the roots; but ſoon after they were all devoured by a number of ſtrange painted owls, v. 148

Mico, the leaſt and moſt beautiful monkey of the ſagoin kind—its deſcription by Mr. La Condamine, iv. 237, 238

Microſcope, encreaſes the magnitude of an object, and that of its motion alſo, ii. 21—the pupil and humours of the eye of the mole diſcovered by it, iv. 2

Migrating fiſhes, the herring and the pilchard take the moſt adventurous voyages—ſtated returns, and regular progreſs of the migrating fiſhes, one of the moſt extraordinary circumſtances in the hiſtory of nature, vi. 318 to 320

Migration, cauſes of migrations of birds, v. 31—in what manner they perform them—at what times—rather follow weather than country, and go on as they perceive the atmoſphere more ſuitable to their wants and diſpoſitions—migration of ſome ſwallows, and retreat of others into old walls, to avoid the rigour of winter, wrap this ſubject in great obſcurity, 32 to 37 —of bees, ſeveral ſigns previous to it, viii. 82

Milan, hares bred in the Milaneſe, thought the beſt in Europe, iv. 13

Milk, infants have it in their own breaſts, ii. 59—ſometimes found in the breaſts of men, as well as in thoſe of women, 102—in carnivorous animals, more ſparing than in others, 337, and iii. 366—of goats, medicinal, and not apt to curdle upon the ſtomach, as that of the cows, iii. 55—of the rein-deer, thinner than that of the cow, but ſweeter, and more nouriſhing, 158—boiled up with wood-ſorrel, by the Laplanders, kept in caſks under ground, to be eaten in winter, 166 —injected into a vein, kills with more certainty than the venom of a viper, vii. 199, 200

Millipedes multiplied by being cut in pieces, ii. 23

Milo, an inſtance of his ſtrength, when he ſtood upright, ii. 118

Milton makes Satan perſonate the cormorant, a moſt nauſeous bird—objection againſt him on this account—his vindication, vi. 64

Minerals mere inactive and inſenſible bodies, ii. 4

Miners firſt become paralytic, then die conſumptive, for the trifling reward of ſeven pence a day, i. 79—peculiar contrivance to ſupply light for their operations —make uſe only of wooden inſtruments in digging, and take out the nails from their ſhoes, before they enter the mine, 82

Mines, the deepeſt that at Cotteberg in Hungary, not more than three thouſand feet deep, i. 51—a coal-mine in the North of England, ſaid to be eleven hundred yards deep, 73—air different in them, proportionably as the magazines of fire lay nearer the center, 75—other cauſes of this difference, 76—Mendip lead-mines, in Somerſetſhire—their deſcription, 77—mines of coal generally leſs noxious than thoſe of tin; tin than thoſe of copper; but none are ſo dreadfully deſtructive as thoſe of quickſilver, 78—deplorable infirmities of workmen in the mines near the village of Idra, 79—metallic, often deſtroy all vegetation by their volatile corroſive fumes—ſalt mines naturally cold, 83—natives of countries abounding in mines, too often experience the noxious effects of their vicinity, 326—in a lead-mine in Flintſhire were found two grinding-teeth, and part of the tuſk of an elephant, at forty-two yards depth, iv. 282

Mingrelians, among the ſixth variety of the human ſpecies, deſcribed, ii. 230

Mint, cats exceſſively fond of the cat-mint, iii. 206

Mire-drum, the bittern, deſcribed, vi. 2 to 5. See *Bittern.*

Miſletoe, a plant thought propagated by ſeeds voided by birds, v. 316

Miſſiſſippi, a great river in North America, i. 216—its ſource and length—receives forty rivers, 218

Miſts continually riſe upon approach of the winter months, under the line, i. 377—called froſt-ſmoke—raiſes bliſters on ſeveral parts of the body, in the regions round the poles, 386

Mite-fly, not found in Lapland, iii. 166

Miume, a river in America — enormous ſkeletons lately diſcovered near it, iv. 282

Mock-bird, deſcription of the American mock-bird, v. 324—its habits—can aſſume the tone of every animal in the wood, from the wolf to the raven—no bird in the foreſt it has not at times deceived by mimicking its call, 325

Mock-ſuns, meteors, and other phænomena, in the northern regions, i. 377, 387

Mococo, firſt of the maki kind, which is the laſt of the monkies—its deſcription—a native of Madagaſcar—its qualities, iv. 239, 240—eats its own tail, and ſeems to feel no pain—ſome other monkies do the ſame, 335

Modena, a city in Italy—its remarkable wells—other rarities round it, i. 282

Mogul, in the Indian language, ſignifies a white man, ii. 224

Mold, black, or garden-earth, the firſt layer on the ſurface of the globe—is formed from animal and vegetable bodies decayed—ſoil fertile, in proportion to the quantity that putrified mold bears to the gravelly mixture, i. 52, 53

Mole, a ruminating inſect, or ſeemingly ſo, iii. 6—no quadrupede fatter, none with a more ſleek gloſſy ſkin — an utter ſtranger in Ireland — formed to live under the earth — its deſcription — the ancients, and ſome moderns, of opinion, that the mole was blind; but Derham, by a microſcope, diſcovered all the parts of the eye known in other animals—a mole let looſe in the midſt of a field, like a ghoſt on a theatre, inſtantly ſinks into the earth; and an active labourer, with a ſpade, purſues it in vain—peculiar advantage of the ſmallneſs of its eyes—when once buried in the earth, it ſeldom ſtirs out—it chuſes the looſer, ſofter grounds—chiefly preys upon worms and inſects—is moſt active, and caſts up moſt earth, immediately before rain, and in winter, before a thaw—in dry weather, it ſeldom forms hillocks—readily evades the purſuit of animals ſtronger and ſwifter than itſelf—its greateſt calamity is an inundation—in ſome places conſidered by the farmer as his greateſt peſt—couples towards ſpring, and the young found about the beginning of May—generally four or five at a time—deſcription of the mole-hill, in which the female has brought forth her young—is ſcarcely found, except in cultivated countries—the varieties are but few—that of Virginia is black, mixed with a deep purple—that of Poland is white—Agricola ſays he ſaw hats made of mole-ſkins, the fineſt and moſt beautiful imaginable, iv. 90 to 98

Moloſſian breed of dogs, and its perfections, ſet forth by Nemeſianus, iii. 294

Molting, annually ſuffered by birds—its effects, v. 18—artificially accelerated, and how—the manner in which nature performs the operation, 19—the ſeaſon commonly obtains from the end of ſummer to the middle of autumn, 20

Molucca Iſlands, Ferdinand Magellan, a Portugueſe of noble extraction, ſlain upon one of them, ii. 260

Mona, the *cephus* of the ancients, a monkey of the ancient continent—its deſcription, iv. 234

Monax, name given to the marmout in Canada, iv. 48

Mongooz, of the maki kind, the laſt of the monkies—its deſcription—is a native of Madagaſcar, iv. 240

Monkey, they ſometimes fall a prey to the lion in deſerts and foreſts, iii. 223, 224—one general deſcription will not ſerve for all the animals of the monkey kind, iv. 189—La Condamine aſſerts it would take up a volume to deſcribe the differences of monkies found along the river of Amazons; and we are ſure that every one of theſe is different from thoſe on the African coaſt—an elaborate deſcription of each muſt be uſeleſs and tireſome, their numbers being very great, and their differences very trifling—thoſe of two cantons never found to mix—of all kinds leſs than the baboon, have leſs power of doing miſchief, and their ferocity diminiſhes with their ſize—do nothing deſired without beating; their fears once removed, they are the moſt inſolent headſtrong animals in nature—in their native woods, are the peſts of other animals, and the maſters of the foreſt where they reſide—the tiger nor the lion will not venture to diſpute dominion with creatures, who, from the tops of trees, with impunity carry on an offenſive war, and by their agility eſcape all purſuit—birds have not leſs to fear from their continual depredations; ſuch being their petulant delight in miſchief, that they fling the eggs againſt the ground, when wanting appetite to devour them, 216 to 219—one only animal in the foreſt ventures to oppoſe them, that is the ſerpent—larger ſnakes often wind up the trees where they reſide, and happening to ſurprize them ſleeping, ſwallow them whole, before they can make defence—they generally inhabit the tops of trees, and the ſnakes cling to the branches nearer the bottom; in this manner they are near each other, like enemies in the ſame field of battle—ſome ſuppoſed their vicinity rather argued mutual friendſhip—father Labat has ſeen them playing their gambols upon thoſe branches on which the ſnakes were repoſing, and jumping over them, without receiving any injury—they provoke the ſnake, as the ſparrows twitter at a cat—when attacked, they ſhew perfect ſkill in defending and aſſiſting each other—they regularly begin hoſtilities againſt thoſe who enter their woods—they take moſt deſperate leaps, and ſeldom come to the ground—one being wounded, the reſt come round, put their fingers into the wound, as deſirous of ſounding its depth—the blood flowing in any quantity, ſome ſtop it, while others get leaves, chew, and thruſt them into the opening—are often killed in numbers before they make a retreat, with the ſame precipitation as they at firſt came on—in this retreat the young are clinging to the back of the female, who jumps away, ſeemingly unembarraſſed by the burthen—uſual way of taking them alive—the monkey not killed outright, does not fall; but clinging to ſome branch, continues, when dead, its laſt graſp, and remains where ſhot, until it drops by putrefaction—ſkinned and ſerved up at negroe-feaſts, ſo like a child, an European is ſhocked at the ſight—the negroes ſeeing Europeans buy young and tame monkies, with equal care brought rats to the factors for ſale, and were greatly diſappointed, finding no purchaſer — negroes cannot comprehend advantages ariſing from educating or keeping animals, who come in companies to lay waſte fields of corn or rice, or plantations of ſugar-canes—they carry off what they are able, and deſtroy ten times more—manner of their plundering—are under a kind of diſcipline, exerciſed among themſelves—account to this purpoſe by Morgrave—one ſpecies, by Mr. Buffon called the ouarine, remarkable for loudneſs and diſtinctneſs of voice—uſe to which they convert it—are generally together in companies, march in exact order, and obey the voice of ſome chieftain, remarkable for his ſize and gravity—chief food of the tribe—extraordinary manner of managing an oyſter, 220 to 227—manner of drawing crabs from the water—no ſnare, however nicely baited, takes a monkey of the Weſt-Indian iſlands—female brings forth one, and ſometimes two at a time—rarely breed when brought into Europe—the male and female never tired of fondling their young, and inſtruct it with no little aſſiduity—often ſeverely correct it, if ſtubborn, or diſinclined to profit by their example—manner of carrying their young in the woods—dexterity in paſſing from one tree to another, by forming a kind of chain, locking tail in tail, or hand in hand—one amuſed itſelf for hours impoſing upon the gravity of a cat, and playing its pranks among rabbits—faithful ſervices which father Carli received from the monkies in Angola, where he went to convert the ſavage natives to Chriſtianity—ſavages of Africa and America ſuppoſe monkies to be men; idle, ſlothful, rational beings, capable of ſpeech and converſation, but obſtinately dumb, for fear of being compelled to labour—monkies of Africa moſt expert and entertaining—ſhew a greater degree of cunning and activity—three marks by which monkies of the new continent are diſtinguiſhed from thoſe of the old—Mr. Buffon makes but nine ſpecies of monkies belonging to the ancient continent, and eleven to the new—their names, with their deſcriptions—the *red African*, the *patas*, ſecond ſort of the ancient continent—the *white noſe*, or *mouſtoc*, of the ancient continent, moſt beautiful; its deſcription—the *green* of St. Jago, alſo called *callatrix*, is of the ancient continent—its deſcription—ſome of the kind eat their own tail, and ſeem to feel no pain—the Bramins have hoſpitals for thoſe that happen to be ſick, or diſabled—thoſe monkies of the new continent with muſcular holding tails, are called ſapajous, and thoſe with feeble uſeleſs tails, are called ſagoins—the *fox-tailed* monkey—*makies*, the laſt of the kind—their deſcription, 228 to 238

Monkey-bezoar, a factitious concrete, iii. 76. See *Bezoar*.

Monoculus, the arboreſcent water-flea—its deſcription—are of a blood-red colour; and ſometimes in ſuch multitudes on ſtanding waters, as to make them appear all over red, whence the water has been thought turned into blood, vii. 288—its branching arms, and the motion made with them in the water, deſerve great attention, 289

Monſoons, ſo called from a famous pilot of that name, who firſt uſed them in navigation with ſucceſs—in that part of the ocean between Africa and India, thoſe of the eaſt winds begin in January, and end at the commencement of June; in Auguſt, or September, the contrary takes place; and the weſt winds blow for three or four months, i. 347—monſoons prevail, at different ſeaſons, throughout the Indies, 348

Monſters, after a catalogue of them, Linnæus particularly adds the ſlender waiſts of the women of Europe, ii. 243

Monſtrous productions, father Malbranche's ingenious theory of—remarkable inſtance related by him, ii. 245, 246

Montaigne, well known to have diſliked thoſe men who ſhut one eye in looking upon an object, ii. 94

Mooſe-deer, name in America for the elk, iii. 140—its deſcription, 144, 145

Mormyrus, deſcription of this fiſh, vi. 309

Morocco, the original horſes there much ſmaller than the Arabian breed, ii. 361

Moron, a kind of ſalamander, thought venomous, vii. 141

Morſe, an animal of the ſeal kind, might be ranked among the fiſhes, ii. 313—generally frequents the ſame places where ſeals reſide in—different from the reſt in a very particular formation of the teeth—reſembles a ſeal, except that it is much larger—are rarely found, but in the frozen regions near the pole—formerly more numerous than at preſent—the Greenlanders deſtroyed them more before thoſe ſeas were viſited by European ſhips upon the whale fiſhery, than now—its teeth generally from two to three feet long—the ivory more eſteemed than that of the elephant—the fiſhers have formerly killed three or four hundred morſes at once; their bones are ſtill lying in prodigious quantities along thoſe ſhores they chiefly frequented, iv. 181, 182

Moſchitoes, exceſſive torments cauſed by them, i. 147 -houſes forſaken on account of them, 147, 148

Moſs, the only ſupport of the rein-deer in Lapland—of two ſorts, white and black, iii. 154

Mother-of-pearl, taken from the pearl oyſter, vii. 55

Moths, difference from butterflies, viii. 38—all the tribe of female moths lay their eggs ſoon after they leave the aurelia, 42

Motion, keeps the water of the ſea ſweet, i. 249—deſtroys numbers of viler creatures, 250—conſtant motion of the waters of the ſea weſtward, 259—principal differences between ſerpentine and vermicular motion, vii. 181—ſome vegetables poſſeſſed of motion, viii. 161—and many animals totally without it—in what manner animals of the worm kind move, 166

Moufflon, the ſheep in a ſavage ſtate, a bold, fleet creature, able to eſcape from greater animals, or oppoſe the ſmaller with arms received from nature, iii. 39—its deſcription, 50

Mountains, riſing from places once level, i. 21—give direction to the courſes of the air, 338—how formed, and for what deſigned—upon our globe, conſidered as angles of ſmall lines in the circumference of a circle, 139 to 140—countries moſt mountainous, are moſt barren and unhabitable, 146—ſome vallies are fertilized by earth waſhed down from great heights, 162—the more extenſive the mountain, the greater the river, 142—tops of the higheſt mountains bare and pointed, and why, 155—tops of land-mountains appear barren and rocky; of ſea-mountains, verdant and fruitful, 290—the higheſt in Africa, thoſe called *of the moon*, giving ſource to the Niger and Nile in Africa, the greateſt and higheſt under the line, 142, 146—ſome riſe three miles perpendicular above the bottom of the ocean, 146—higheſt in Aſia; mount Caucaſus makes near approaches to the Andes in South America, 153—burning in Europe, 89—in Aſia, 98—in the Molucca iſlands—in Africa—in America, thoſe of the Andes—thoſe of Arequipa, Caraſſa, Malahallo, and Cotopaxi, 99—deſcription of the latter by Ulloa; and an eruption of it, 100

Mouſe, the moſt feeble, and moſt timid of all quadrupedes, except the Guinea-pig—never rendered quite familiar; though fed in a cage, retains its apprehenſions—no animal has more enemies, and few ſo incapable of reſiſtance—the owl, cat, ſnake, hawk, weaſel, and rat deſtroy them by millions—brings forth at all ſeaſons, and ſeveral times in the year; its uſual number from ſix to ten—theſe in a fortnight ſtrong enough to ſhift for themſelves—places where chiefly found—Ariſtotle, having put a mouſe with young into a veſſel of corn, ſome time after found a hundred and twenty ſprung from that original—its life laſts two or three years—the ſpecies found in all parts of the ancient continent, and has been exported to the new—Geſner minutely deſcribes the variety of mouſe-traps—long-tailed field-mouſe—ſhort-tailed field-mouſe—has a ſtore againſt winter, a buſhel at a time—a deſcription of the ſhrew-mouſe, iv. 72 to 75

Mouſtoc, or *white noſe*, monkey of the ancient continent; a beautiful little animal—its deſcription, iv. 234

Mouth of hares lined with hair—the only animals that have it on the inſide, iv. 8—the ſnails of the trochus kind have none—mouth of garden, water, and ſea-ſnails, vii. 32, 33

Mucous liquor, giving the joints an eaſy and ready play, ii. 196

Mugil, the mullet, deſcription of this fiſh, vi. 304

Mule, reputed barren, though Ariſtotle ſays it is ſometimes prolific, ii. 375 — engendered between a horſe and a ſhe-aſs, or a jack-aſs and a mare, 386—inhabitants of mountainous countries cannot do without them—how they go down the precipices of the Alps and Andes—a fine mule in Spain worth fifty or ſixty guineas—common mule very healthy—lives thirty years and more, 387—in South America, deſtroyed by a bat called vampyre, iv. 145

Mullus, or *ſurmulet*, deſcription of this fiſh, vi. 302

Multivalve ſhells, third diviſion of ſhells by Ariſtotle, vii. 12—two principal kinds of multivalve ſhell-fiſh, moving and ſtationary, 61

Mummy, formerly a conſiderable article in medicine—Paræus wrote a treatiſe on the inefficacy of mummy in phyſic—counterfeited by the Jews, and how—the method of ſeeking for mummies—found in the ſands of Arabia, in Egypt, in wooden coffins, or in cloaths covered with bitumen, ii. 275 to 280—remarkable mummy dug up at Auvergne, in France, 283—an injection of petreoleum inwardly, and a layer of aſphaltum without, ſuffice to make a mummy, 287

Muræna, the eel, its deſcription, vi. 305

Murena of the ancients, not our lamprey, vi. 265

Muralto, has given the anatomy of the lamprey, but made no mention of lungs, vi. 267

Muſcardin, name of the leſſer dormouſe by Mr. Buffon, iv. 76

Muſcles, to judge of the ſtrength of animals by the thickneſs of their muſcles inconcluſive, ii. 120—thoſe of the hare are ſtrong, and without fat, iv. 4—the pectoral muſcles of quadrupedes trifling in compariſon to thoſe of birds—in quadrupeds, as in man, the muſcles moving the thighs and hinder parts are ſtrongeſt, while thoſe of the arms are feeble—in birds, the contrary obtains, v. 8—thoſe of the ſhark preſerve their motion after being ſeparated from the body, vi. 240

Muſcle, the ſhell fiſh, its deſcription—its organs of generation are what moſt deſerve to excite our curioſity —it endeavours to become ſtationary, and to attach itſelf to any fixed object it happens to be near—its enemies—it is ſuppoſed that thoſe threads, which are uſually called the beard of the muſcle, are the natural growth of the animal's body, and by no means produced at pleaſure, as Reamur ſuppoſes—its inſtrument of motion, by which it contrives to reach the object it wants to bind itſelf to—its food—ſome of this kind have been found a foot long—the natives of Palermo ſometimes make gloves and ſtockings of its beards—the places where found—it requires a year for the peopling a muſcle-bed, vii. 42 to 47

Muſcovy-duck, or the *muſk-duck*, ſo called from a ſuppoſed muſky ſmell, vi. 127

Muſic, ſaid by the ancients, to have been invented from the blows of different hammers on an anvil—from the remains of ancient muſic, collected by Meibomius, one might ſuppoſe nothing powerful in what is loſt—in all countries, where muſic is in its infancy, the half tones are rejected—many barbarous nations have their inſtruments of muſic; and the proportion between their notes is the ſame as in ours—all countries pleaſed with muſic; and where they have not ſkill to produce harmony, they ſubſtitute noiſe—its effects, the ancients give us many ſtrange inſtances of them upon men and animals—and the moderns likewiſe—madneſs cured by it—remarkable inſtance in Henry IV. of Denmark—it is now well known that the ſtories of the bite of the tarantula, and its cure by muſic, are all deceptions—inſtance of it—fiſhes are allured by muſic—horſes and cows likewiſe, ii. 165 to 171—the elephant appears delighted with muſic, iv. 258—father Kircher has ſet the voices of birds to muſic, v. 143

Muſk, among the numerous medicines procurable from quadrupedes, none, except the muſk and hartſhorn, have preſerved a degree of reputation, iii. 69—a doubt whether the animal producing it be a hog, an ox, a goat, or a deer—no animal ſo juſtly the reproach of natural hiſtorians as that which bears the muſk—it has been variouſly deſcribed, and is known very imperfectly —the deſcription given by Grew—formerly in high requeſt as a perfume—has for more than a century been imported from the Eaſt—is a duſky reddiſh ſubſtance, like coagulated blood—a grain of it perfumes a whole room—its odour continues for days, without diminution, and no ſubſtance known has a ſtronger or more permanent ſmell—in larger quantity it continues for years; and ſcarce waſted in weight, although it has filled the atmoſphere to a great diſtance with its parts—the bags of muſk from abroad ſuppoſed to belong to ſome other animal, or taken from ſome part of the ſame, filled with its blood and enough of the perfume to impregnate the reſt—it comes from China, Tonquin, Bengal, and often from Muſcovy—that of Thibet reckoned the beſt, and of Muſcovy the worſt, 88 to 93

Muſk-rat, three diſtinctions of it, iv. 78—it is called *ſtinkard* by the ſavages of Canada, 80

Muſky ſmell, does not make the characteriſtic marks of any kind of animals, iii. 32

Muſmon, or *muſflon*, reſembles a ram, its deſcription, iii. 49, 50

Myoides, a broad thin ſkin covering the whole upper fore-part of the body, its effect in women with child, ii. 104

N.

Nails, how formed in man, ii. 101—thoſe of ſome of the learned men in China longer than their fingers—ſavages that let them grow long, uſe them in flaying animals, 106

Nanquin, a river in Aſia, receives thirty rivers, i. 217

Narwhal, the ſea-unicorn—its deſcription—errors concerning the teeth of this animal—the moſt harmleſs and peaceful inhabitant of the ocean—the Greenlanders call it the forerunner of the whale; and why—its food —is a gregarious animal—a century ago its teeth conſidered the greateſt rarity in the world—were believed to belong to a very different animal—for ſome time after the narwhal was known, the deceit was continued—they far ſurpaſs ivory in its qualities, vi. 207 to 212

Natolian goat, a remarkable variety in the goat-kind, iii. 57

Nature laviſh of life in the lower orders of creation, ii. 49—ſhe has kindly hid our hearts from each other, to keep us in good humour with our fellow-creatures, 95—has brought man into life with more wants and infirmities than the reſt of her fellow-creatures, 123—in a courſe of ages ſhapes herſelf to conſtraint, and aſſumes hereditary deformity—inſtances of it, 238—has contracted the ſtomachs of animals of the foreſt, ſuitable to their precarious way of living, 124—has left no part of her fabrick deſtitute of inhabitants, v. 1—and by ſupplying a variety of appetites, has multiplied life in her productions, 79—what might have led ſome late philoſophers into the opinion that all nature was animated, viii. 199

Nautilus, a ſea-ſnail, moſt frequently ſeen ſwimming—its ſhell very thin, and eaſily pierced, vii. 35—its deſcription, 36—it is certain that it ſometimes quits its ſhell, and returns to it again—peculiarity for which it has been moſt diſtinguiſhed, 37

Nazareth bird, whether the dodo or not, is uncertain, v. 78

Neck, fiſhes have none—birds, in general, have it longer than any other kind of animals, ii. 102—in women, it is proportionably longer than in men, ii. 107

Nectarium, the part of a flower from which the honey is extracted, viii. 75

Negroes of the Leeward iſlands, by the ſmell alone, diſtinguiſh the footſteps of a Frenchman from thoſe of a negroe, ii. 180—ſeveral of them have white beards, and black hair—deſcribed—their features not deformed by art, 227—the women's breaſts, after bearing one child, hang down below the navel, and are thrown over the ſhoulder to ſuckle the child at their backs, 228—the jet black claim the honour of hereditary reſemblance of our common parent—an argument ſufficient to prove the contrary—two white negroes the iſſue of black parents, 240—ſhew their terror and ſurprize, when they firſt ſee a horſe, 346—of the African coaſts regard the bat with horror, and will not eat it, though ready to ſtarve, iv. 141—happy to ſee numbers of monkies deſtroyed, becauſe they dread their devaſtations, and love their fleſh, 223—cannot comprehend advantages ariſing to Europeans from educating or keeping monkies—and having ſeen young and tame monkies bought, have offered rats for ſale to our factors, and been greatly diſappointed at finding no purchaſer, 224—diſtractedly fond of the fleſh of the ſhark, vi. 243—their manner of killing it, 241

Negroland, or Nigritia, the plague not known in it, i. 328—its inhabitants are the darkeſt of all blacks, ii. 235

Nerves, wherever they go, or ſend their branches in number, theſe parts are ſooneſt begun, and moſt completely finiſhed, ii. 146

Neſs, or Nethe, a river near Bruges in Flanders—great quantities of trees found in its mouth, at the depth of fifty feet, i. 281

Neſt, of every ſpecies of birds has a peculiar architecture—where eggs are numerous, the neſt muſt be warm, v. 24—different places which birds chooſe for their neſts, 25—deſcription of the neſt of an eagle found in the Peak of Derbyſhire, 93—of the bald eagle, large enough to fill the body of a cart, 96—hanging neſts in Braſil, 254—made in ſuch manner, as to have no opening but at the bottom, 256—the Chineſe get thoſe of the ſwallows from the rocks, and ſell them in great numbers in the Eaſt Indies, where they are eſteemed great delicacies, and eat diſſolved in chicken, or mutton-broth, 350—that of the waſp one of the moſt curious objects in natural hiſtory—its deſcription, viii. 97 to 101

Netherlands, their inhabitants improved us in the woollen manufacture, iii. 44

Nettles, how uſed to teach capons to clutch a freſh brood of chickens throughout the year, v. 169

Nettles of the ſea, name given by ſome to the ſtar-fiſh, viii. 175

New Providence, one of the Bahama iſlands—the Philoſophical Tranſactions give account of poiſonous qualities in the fiſh found on the coaſt of this iſland—all kinds at different times dangerous; one day ſerving for nouriſhment, and the next proving fatal, vi. 343

Nicola Peſce, a celebrated diver—his performances related by Kircher—he often ſwam over from Sicily into Calabria, carrying letters from the king—frequently known to ſpend five days in the midſt of the waves, without any other proviſions than the fiſh he caught there, and ate raw, i. 293, 294

Nieper, or Boriſthenes, a river riſing in the middle of Muſcovy, and running three hundred and fifty leagues to empty itſelf in the Black Sea, i. 210

Niger, this river has a courſe of ſeveral hundred miles from its ſource, at the mountains of the moon, i. 142—confidently aſſerted that it is loſt before it reaches the ocean, 225

Nightingale, a bird of the ſparrow-kind, v. 314—deſcription of its melody by Pliny, 326—its reſidence—for weeks together, undiſturbed, it ſits upon the ſame tree—its neſt, and eggs—its ſong in captivity, not ſo alluring—Geſner ſays it is poſſeſſed of a faculty of talking—ſtory related by him in proof of this aſſertion—its food, and in what manner they muſt be kept—manner of catching the nightingale, and managing them when caught—the black-cap called by ſome the mock-nightingale, v. 328 to 338

Nile, its courſe—its ſources aſcertained by miſſionaries—takes its riſe in the kingdom of Goiam—receives many leſſer rivers—Pliny miſtaken, in ſaying that it received none—the cauſe of its annual overflowings—time of their encreaſe and decreaſe more inconſiderable now than in the time of the ancients, i. 212 to 214

Noiſe, the mind prediſpoſed to joy, noiſe fails not to encreaſe into rapture—and thoſe nations which have not ſkill enough to produce harmony, readily ſubſtitute noiſe—loud and unexpected, diſturbs the whole frame; and why, ii. 167

Noort (Oliver Van) a traveller who confirms the exiſtence of giants, ii. 261

Norfolk, along its coaſts, the ſea has gained fifty yards in ſome places, and loſt as much in others, i. 277

Norway, the ſea has formed ſeveral little iſlands from its main land, i. 278—there are lands in it at one time covered with water, and another free, 2 iſtory of that kingdom does not intimate that aſſes have yet reached that country, ii. 385—the iſatis, a ſpecies between the dog and the fox, found in this country, iii. 340—the firſt great bank for herrings was along theſe ſhores, vi. 325

Noſe, that of the Grecian Venus ſuch as would appear at preſent an actual deformity, iii. 76—the form of the noſe, and its advanced poſition, peculiar to the human viſage—among the tribes of ſavage men, the noſe is very flat—a Tartar ſeen in Europe with little more than two holes through which to breathe, 89—whence originally may have come the flat noſes of the blacks, 239

Noſtrils, wide, add a great deal to the bold and reſolute air of the countenance, ii. 89—of the cetaceous tribe, vi. 182—two in the great Greenland whale, 193

Note of the ſloth, according to Kircher, an aſcending and deſcending hexachord, uttered only by night, iv. 346

Notonecta, the common water-fly—ſwims on its back, to feed on the under-ſide of plants growing in water, vii. 359

Numidia, the plague not known in it once in an hundred years, i. 328—its race of horſes much degenerated, ii. 356

Numidian bird, or Guinea-hen, deſcribed, v. 192

Numidian crane, its peculiar geſtures and contortions, v. 391

Nux vomica, ground and mixed with meal, the moſt certain poiſon, and leaſt dangerous, to kill rats, iv. 70—fatal to moſt animals, except man, v. 170

Nyl-ghaw, an animal between the cow and the deer, native of India—its deſcription—diſpoſition and manners of one brought over to this country—its manner of fighting—at all our ſettlements in India they are conſidered as rarities, iv. 318 to 320

O.

Oaks of Hatfield Chace Levels, as black as ebony, very laſting and cloſe grained, ſold for fifteen pounds a-piece, i. 284

Objects, we ſee them in an inverted poſition, ii. 147—not the feeling only, but the colour and brightneſs of objects, contribute to form an idea of the diſtance at which they appear—the power of ſeeing objects at a diſtance rarely equal in both eyes—in near-ſighted perſons, the beſt eye ſees every object the largeſt, 156 to 158

Oby, in Tartary, a river of five hundred leagues, running from the lake of Kila into the Northern Sea, i. 210—receives above ſixty rivers, 217

Ocean occupies conſiderably more of the globe than the land, i. 227—its different names—all the rivers in the world flowing into it, would, upon a rude computation, take eight hundred years to fill it to its preſent height, 228—ſavages conſider it as an angry deity, and pay it the homage of ſubmiſſion, 231—the bays, gulphs, currents and ſhallows of it much better known and examined than the provinces and kingdoms of the earth, and why—when England loſes its ſuperiority there, its ſafety begins to be precarious, 233—opinions concerning its ſaltneſs, and that of Boyle particularly, 234—winds never change between the tropics in the Atlantic and Ethiopic Oceans, 340—each has its inſects, ii. 7—and its vegetables, 6

Ocelot, or cat-a-mountain, its deſcription—of the panther-kind—one of the fierceſt, and, for its ſize, one of the moſt deſtructive animals in the world—its unceaſing appetite rather for the blood than the fleſh of their prey—it generally is on the tops of trees, like our wild cats, iii. 255 to 264

Ocotzimtzcan, a kind of pigeon, one of the moſt ſplendid tenants of the Mexican foreſts, v. 295

Odours diffuſed by the air as the fluid they ſwim in, i. 334

Ohio, ſeveral enormous ſkeletons five or ſix feet beneath the ſurface on the banks of that river, lately diſcovered, iv. 282

Oil, train-oil the drink of the Laplanders, ii. 216—the oil of the fiſh cachelot is very eaſily converted into ſpermaceti, vi. 215—the porpeſſe yields a large quantity of it, 223—the liver of the ſhark affords three or four quarts of oil, 243—by the application of ſallad-oil, the viper's bite is effectually cured, vii. 206

Oker, the North-American Indians paint their ſkins with red oker, ii. 236

Old man's-beard, a kind of moſs growing in Braſil, v. 255

Olearius, invited by the monarch of Perſia to a ſport of wild aſſes, ii. 377

Olive colour, the Aſiatic of that colour claims the honour of hereditary reſemblance to our common parent —an argument ſufficient to prove the contrary, ii. 240

Oliver (William) the firſt who diſcovered that the application of ſallad-oil cured the viper's bite effectually, vii. 206

Onager, or the wild aſs, is in ſtill greater abundance than the wild horſe, ii 376

Ondatra, one of the three diſtinctions of the muſk-rat —a native of Canada—creeps into holes where others ſeemingly leſs cannot follow—the female has two diſtinct apertures, one for urine, the other for propagation —this animal in ſome meaſure reſembles the beaver— its manner of life during winter, in houſes covered under a depth of eight or ten feet of ſnow—ſavages of Canada cannot abide its ſcent, call it ſtinkard—its ſkin very valuable, iv. 78 to 80

Onza, or ounce, of the panther-kind, iii. 254—the onza of Linnæus, 255

Ophidium, the gilt-head, by ſailors called the dolphin, its deſcription, vi. 299

Oppoſſum, the female's belly found double — when purſued, ſhe inſtantly takes her young into a falſe belly nature has given her, and carries them off, or dies in the endeavour, ii. 336—an animal in North and South America, of the ſize of a ſmall cat, and of the monkey-kind—its deſcription, iv. 188 and 242—a minute deſcription of it—the young, when firſt produced are very ſmall, and immediately on quitting the real womb, they creep into the falſe one, but the time of continuance is uncertain—Ulloa has found five young hidden in the belly of the dam, alive and clinging to the teat, three days after ſhe was dead—chiefly ſubſiſts upon birds, and hides among the leaves of trees, to ſeize them by ſurprize—cannot run with any ſwiftneſs, but climbs trees with great eaſe and expedition—it often hangs by the tail, and for hours together, with the head downwards, keeps watching for its prey—by means of its tail, flings itſelf from one tree to another, hunts inſects, and eſcapes its purſuers—eats vegetables as well as animal ſubſtances—is eaſily tamed, but a diſagreeable domeſtic, from its ſtupidity, figure, and ſcent, which, though fragrant in ſmall quantities, is ungrateful when copious—during its geſtation, the bag in which the young are concealed may be opened and examined without inconvenience; the young may be counted and handled; they keep fixed to the teat, and cling as firm as if they made a part of the body of the mother, iv. 243 to 247

Orange flowers, particularly grateful to the taſte and ſmell of the elephant, iv. 259

Orb, deſcription of the ſea-orb, alſo called the ſea-porcupine—is abſolutely poiſonous, if eaten, vi. 286

Ore of tin is heavier than that of other metals, i. 74—the baſeſt ores in general the moſt beautiful to the eye, 75

Organs of digeſtion, in a manner, reverſed in birds, v. 16

Organs of generation in fiſhes, vi. 175

Orifices, or different verges of ſnails, vii. 31

Orkney Iſlands, on their ſhores, the ſea, when agitated by ſtorm, riſes two hundred feet perpendicular, i. 271—a law in thoſe iſlands entitles any perſon that kills an eagle to a hen out of every houſe in the pariſh in which it is killed, v. 92

Oroonoko, a river in South America, its ſource and length, i. 216

Ortolan, a bird of the ſparrow-kind, v. 315

Oſprey, its fleſh is liked by many, and, when young, an excellent food according to Belonius, v. 85—it chiefly lives upon fiſh, 95—its diſtinctive marks, 98

Oſtiac Tartars, a race that have travelled down from the North, ii. 219

Oſtracion, a fiſh of the cartilaginous kind, is poiſonous, vi. 286

Oſtrich, manner in which the Arabians hunt them, ii. 348 and v. 60—an Arabian horſe of the firſt ſpeed ſcarcely outruns them, 348—its fleſh proſcribed in Scripture as unfit to be eaten—the greateſt of birds, makes near approaches to the quadrupede claſs—its deſcription—appears as tall as a man on horſeback—brought into England above ſeven feet high — ſurpriſing conformation of its internal parts — a native only of the torrid regions of Africa—not known to breed elſewhere than where firſt produced—places they inhabit—the Arabians ſay it never drinks—will devour leather, glaſs, hair, iron, ſtones, or any thing given—in native deſerts, lead an inoffenſive ſocial life—Thevenot affirms the male keeps to the female with connubial fidelity—thought much inclined to venery—ſome of their eggs weigh fifteen pounds—ſeaſon for laying depends on the climate where the animal is bred—theſe birds very prolific, and lay from forty to fifty eggs at one clutch—none has a ſtronger affection for her young, nor watches her eggs with greater aſſiduity, ſit on them, like other birds, male and female by turns—aſſiduous in ſupplying the young with graſs, and careful to defend them, encountering every danger boldly—way of taking them among the ancients—the plumes uſed in their helmets—the ladies of the Eaſt uſe them as ornaments in their dreſs—plumes uſed in Europe to decorate our hearſes and hats—feathers plucked from the animal while alive more valued than thoſe taken when dead—ſome ſavage nations of Africa hunt them for their fleſh—Heliogabalus had the brains of ſix hundred dreſſed in one diſh—a ſingle egg ſufficient entertainment for eight men—eggs well taſted, and extremely nouriſhing—Apicius gives a receipt of ſauce for the oſtrich—of all chaces, that of the oſtrich, though moſt laborious the moſt entertaining, v. 49 to 59—uſe they make of its ſkin—method of hunting of the Struthophagi—its blood mixed with the fat a great dainty with the Arabians—inhabitants of Dara and Lybia breed flocks of them—tamed with little trouble—prized for more than feathers in this domeſtic ſtate—often ridden upon and uſed as horſes—Moore aſſures he ſaw a man at Joar travelling upon an oſtrich; and Adanſon aſſerts he had two young oſtriches, the ſtrongeſt of which ran ſwifter than the beſt Engliſh racer, with two negroes on his back—of all animals uſing wings with legs in running, theſe by far the ſwifteſt —

parts of it convertible to medicinal purpoſes—eggs, worſt of all to be eaten according to Galen—the American oſtrich, v. 61 to 64

Otter of roſes, a modern perfume, valued for its vegetable fragrance, iii. 394

Otter, the link between land amphibious animals, reſembles terreſtrial in make, and aquatic in living—ſwims faſter than it runs—is brown, and like an overgrown weaſel—its deſcription—voracious animal, found near lakes—not fond of fiſhing in running water, and why—when in rivers, always ſwims againſt the ſtream, to meet rather than purſue the fiſh it preys upon—in lakes, deſtroys more than it devours, and ſpoils a pond in a few nights—tears to pieces the nets of the fiſhers—two different methods of fiſhing practiſed by it—infects the edges of lakes with the dead fiſh it leaves—often diſtreſſed for proviſion in winter, when lakes are frozen, and then obliged to live upon graſs, weeds, and bark of trees—its retreat the hollow of a bank made by the water—there it forms a gallery ſeveral yards along the water—how it evades the fowler—time of coupling—deſcription of its habitation—way of training it up to hunt fiſh, and, at the word of command, drive them up to the corner of a pond, ſeize the largeſt, and bring it in its mouth to its maſter—to take an old otter alive not eaſy—few dogs dare to encounter it—marks of its reſidence—bites with great fierceneſs, and never lets go its hold—brings forth its young under hollow banks upon beds of ruſhes, flags, or weeds—manner of taking the young alive—how fed when taken—continues long without food—couples about midſummer in Europe, and brings forth at nine weeks end, three or four at a time—ſome dogs trained up to diſcover its retreat—otters met with in moſt parts of the world—in North America and Carolina found white, inclining to yellow—deſcription of the Braſilian otter, iv. 149 to 157

Ovaria, two glandular bodies near the womb, reſembling the cluſter of ſmall eggs found in fowls, ii. 17

Ouarine ſpecies of monkies ſo called by Mr. Buffon, remarkable for the loudneſs of their voice, and the uſe to which they apply it, iv. 226, 227

Oviparous animals, diſtinguiſhed from the viviparous, the two claſſes for generation; all other modes held imaginary and erroneous, ii. 22

Ourang-outang, the wild man of the wood, an animal nearly approaching the human race, is the foremoſt of the ape-kind—this name given to various animals walking upright; but of different countries, proportions and powers—the troglodyte of Bontius, the drill of Purchas, and the pygmy of Tyſon have received this general name—its deſcription in a comparative view with man—gigantic races of it deſcribed by travellers truly formidable—many are taller than man, active, ſtrong, intrepid, cunning, laſcivious, and cruel—countries where found—in Borneo the quality courſe him as we do the ſtag, and this hunting is a favourite amuſement of the king—runs with great celerity—its deſcription—Battel calls him pongo; aſſures us that in all he reſembles man, but is larger to a gigantic ſtate—a native of the tropical climates—he lives upon fruits, and is not carnivorous—goes in companies; and this troop meeting one of the human ſpecies without ſuccour, ſhew him no mercy—they jointly attack the elephant, beat him with clubs, and force him to leave that part of the foreſt they claim as their own—is ſo ſtrong, that ten men are not a match for it—none of the kind taken but very young—one of them dying, the reſt cover the body with leaves and branches—a negro boy taken by one of theſe, and carried into the woods, continued there a whole year without any injury—they often attempt the female negroes going into the woods, and keep them againſt their wills for their company, feeding them plentifully all the time—a traveller aſſures, that he knew a woman of Loango that lived among them for three years—they build ſheds, and uſe clubs for their defence—ſometimes walk upright, and ſometimes upon all fours, when phantaſtically diſpoſed—tho' it reſembles man in form, and imitates his actions, it is inferior in ſagacity even to the elephant or the beaver—two of theſe creatures brought to Europe diſcovered an aſtoniſhing power of imitation, ſate at table like men, ate of every thing without diſtinction, made uſe of knife, fork, and ſpoon, drank wine and other liquors—the male of theſe two creatures being ſea-ſick, was twice bled in the arm; and afterwards, when out of order, he ſhewed his arm as deſirous of relief by bleeding—another was ſurpriſingly well behaved, drank wine moderately, and gladly left it for milk or other ſweet liquors—it had a defluxion upon the breaſt, which encreaſing cauſed its death in the ſpace of one year from its arrival, iv. 189 to 204

Ounce, or onza, remarkable for being eaſily tamed, and employed all over the Eaſt for the purpoſes of hunting, iii. 85, 86—diſtinguiſhed from the panther, the ounce of Linnæus, 255—one at preſent in the Tower of London, with which the keeper plays without the ſmalleſt apprehenſion, 260—does not purſue by the ſmell like the dog-kind, 261—manner of hunting with it—the hyena attacks it, and ſeldom fails to conquer, 343

Owl, deſcription of the common horned owl, v. 85, 86—the ſkreech-owl, and its diſtinctive marks, 86—common mark by which all birds of this kind are diſtinguiſhed from others—general characteriſtics of birds of the owl-kind—though dazzled by a bright day-light, they do not ſee beſt in darkeſt nights, as imagined—ſeaſons in which they ſee beſt—nights of moon-light the times of their ſucceſsful plunder—ſeeing in the night, or being dazzled by day, not alike in every ſpecies of this kind—inſtances in the white, or barn-owl, and in the brown horn owl—deſcription of the great horned owl—names of ſeveral owls without horns—theſe horns nothing more than two or three feathers that ſtand up on each ſide of the head over the ear—times of making their excurſions—places where found in the day-time—father Kircher having ſet the voices of birds to muſic, has given all the tones of the owl note, which make a moſt tremendous melody—ſometimes bewildered—what they do in that diſtreſs—averſion of ſmall birds to the owl—how they injure and torment him in the day-time—an owl appearing by day ſets a whole grove into an uproar—ſmall birds ſometimes hunt the owl until evening, when recovering ſight, he makes the foremoſt pay dear for their ſport, and does not always leave man an unconcerned ſpectator—ſport of bird-catchers, by counterfeiting the cry of the owl—in what manner the great horned owl is uſed by falconers to lure the kite, when wanted for training the falcon—

places where the great horned owl breeds—its neſt, and number of eggs—the leſſer owl takes by force the neſt of ſome other bird—number of eggs—the other owls build near the place where they chiefly prey—a ſingle owl more ſerviceable than ſix cats, in ridding a barn of mice—an army of mice devoured at Hallontide by a number of ſtrange painted owls—are ſhy of man, extremely untractable, and difficult to tame—the white owl in captivity refuſes all nouriſhment, and dies of hunger—account of Mr. Buffon to this purpoſe, v. 137 to 148

Ox, its eyes are brown, ii. 83—on the fertile plains of India it grows to a ſize four times as large as the ſame kind bred in the Alps, 237—one in England ſixteen hands high; its growth depends on the richneſs of paſture, iii. 13

Oxney, an iſland near Romney marſh, in what manner produced, i. 275

Oyſters, a horſe known to be fond of oyſters, ii. 327—ſurpriſing manner in which monkies manage an oyſter, iv. 227—bivalved ſhell-fiſh, are ſelf-impregnated—the particulars in which they differ from the muſcle—growing even amidſt branches of the foreſt—have no other ſeeming food than the afflux of ſea-water—they are depoſited in beds where the tide comes in, at Colcheſter, and other places of the kingdom—theſe ſaid to be better taſted—amazing ſize of oyſters along the coaſt of Coromandel, vii. 48 to 51—the pearl oyſter has a large whitiſh ſhell, the internal coat of which is the mother-of peal, 55

P.

Paca, improperly called American rabbit, an animal of South America—its cry, and manner of eating—is moſt like the agouti, yet differs in ſeveral particulars—its deſcription—places where generally found—its fleſh conſidered a delicacy, and eaten, ſkin and all, like a young pig—is ſeldom taken alive, defending itſelf to the laſt extremity—perſecuted not only by man, but by every beaſt and bird of prey—breeds in ſuch numbers, the diminution is not perceptible, iv. 52 to 54

Pachomac deſerts, where the formidable bird condor is chiefly ſeen, men ſeldom venture to travel; hiſſing ſerpents, and prowling panthers, being the ſcattered inhabitants, v. 105, 106

Pacific ſea, the winds never change in it, i. 340

Pacos, a kind of camel in South America—its wool very valuable, iv. 317

Paddock moon, the ſilence of frogs in dry weather, may ſerve to explain an opinion, that there is a month in the year ſo called, in which they never croak, vii. 88

Pain, nothing but repeated experience ſhews how ſeldom pain can be ſuffered to the utmoſt, ii. 208

Painters never fully imitate that bold relievo, which both eyes give to the object, ii. 150

Paleneſs often the effect of anger, and almoſt ever the attendant of fright and fear, ii. 93

Palm-tree, its juice drank by the rouſette, or the great bat of Madagaſcar, iv. 142—the elephant eats the ſhoots, leaves, and branches, to the ſtump, 259

Pambamarca, mountain at Quito in Peru—a very uncommon meteor ſeen upon it by Ulloa, i. 383

Pangolin, vulgarly the ſcaly lizard, is a native of the torrid climates of the ancient continent—of all animals, the beſt protected from external injury—its deſcription—at the approach of an enemy, it rolls itſelf up like the hedge-hog—the tyger, panther, and hyena make vain attempts to force this animal, when it rolls itſelf up like the hedge-hog—its fleſh is conſidered by the negroes of Africa as a great delicacy—it has no teeth—lives entirely upon inſects—there is not a more harmleſs, inoffenſive creature than this, unmoleſted—cunning in hunting for its prey—chiefly keeps in the obſcure parts of the foreſts—its tongue, when extended, is ſhot out above a quarter of a yard beyond the tip of the noſe—countries where found, iv. 118 to 124

Panther, it naturally hunts the ſheep and the goat, ii. 320—the foremoſt of the miſchievous ſpotted kind, by many naturaliſts miſtaken for the tyger—the panther of Senegal—the large panther—difference between theſe two—that of America, or jaguar, compared with the two former, iii. 250 to 253—ſometimes employed in hunting—the gazelle, or leveret, are its prey—it ſometimes

times attacks its employer, 260—attends to the call of the jackall, 337

Par, a peaſant, lived to a hundred and forty-four, without being abſtemious, ii. 201

Paradiſe-bird, few have more deceived and puzzled the learned than this—it is an inhabitant of the Molucca iſlands—erroneous reports concerning this bird, and what has given riſe to them—the native ſavages of thoſe iſlands carefully cut off its legs before they bring it to market, and why—two kinds of the bird of Paradiſe—their diſtinction from other birds—the deſcription of this bird—found in great numbers in the iſland of Aro, where the inhabitants call it God's bird—live in large flocks, and at night perch upon the ſame tree—are called by ſome the ſwallows of Ternate, and, like them, have their ſtated times of return—their king diſtinguiſhed from the reſt by the luſtre of his plumage, and the reſpect and veneration paid to him—killing the king, the beſt chance of getting the flock—chief mark to know the king, is by the ends of the feathers in the tail, having eyes like thoſe of the peacock—a number of theſe birds taken, the method is to gut them, cut off their legs, dry the internal moiſture with a hot iron, and fill the cavity with ſalt and ſpices, then ſell them to the Europeans for a mere trifle—how this bird breeds, or what the number of its young, remains for diſcovery—for beauty, it exceeds all others of the pie kind, v. 257 to 262

Parakeets, a kind of parrot of a leſſer ſize, v. 273—of that kind in Braſil, Labat aſſures us, there are the moſt beautiful in plumage, and the moſt talkative birds in nature, 281. See *Parrot*.

Parana, a river in South America, wherewith, at eight hundred leagues from its ſource, the Plata runs to its mouth, i. 216

Paraſina, name given by the Italians to a fiſhing line, not leſs than twenty miles long—baited with ten or twelve thouſand hooks, and ſunk to the bottom along the coaſt in the Mediterranean, for that fiſhing called the *pielago*, vi. 254

Paraſite plants, not able to ſupport themſelves, grow and fix upon ſome neighbouring tree, ii. 10

Parrot, the middle or ſecond ſize of the kind, deſcribed—the eaſe with which this bird is taught to ſpeak, and the number of words it is capable of ſpeaking, are ſurpriſing—a grave writer affirms, that one of theſe was taught to repeat a whole ſonnet from Petrarch—the author has ſeen one taught to pronounce the ninth commandment articulately—account of a parrot belonging to king Henry VII. which fell into the Thames, crying, *A boat, twenty pound for a boat*—Linnæus makes its varieties amount to forty-ſeven; Briſſon extends his catalogue to ninety-five; and the author thinks them numberleſs—aſſertion, that the natives of Braſil by art change the colour of a parrot's plumage—peculiarities obſerved in their conformation—common enough in Europe; will not, however, breed here—loſes ſpirits and appetite during the rigour of winter—inſtances of ſagacity and docility, particularly of the great parrot, called aicurous—their habits—their neſts, and the number of eggs—uſual method of taking the young—always ſpeak beſt, when not accuſtomed to harſh wild notes—what fruit or grain theſe birds feed upon, their fleſh partakes of the flavour and taſte—inſtances of it—ſeed of the cotton-tree intoxicates them, as wine does man—wine renders them more talkative and amuſing—in France very expert, but nothing to thoſe of Braſil, which Cluſius ſays are moſt ſenſible and cunning—natives of Braſil ſhoot them with heavy arrows, headed with cotton, which knock down the bird without killing it—thoſe of the parakeet tribe are delicate eating—of this kind in Braſil, Labat aſſures there are the moſt beautiful in plumage, and the moſt talkative poſſible—are reſtleſs, and ever on the wing—their habits—their outcry when their companions fall—are very deſtructive on the coaſt of Guinea—more than a hundred different kinds counted on the coaſt of Africa—the white ſort called lories—countries where found—one, north of the Cape of Good Hope, takes its name from the multitude of parrots in its woods—a hundred kinds now known, not one of which naturally breeds in countries that acknowleged the Roman power — the green parakeet, with a red neck, was the firſt of the kind brought into Europe, and the only one known to the ancients, from Alexander the Great to Nero—diſorders peculiar to the parrot kind—one well kept will live five or ſix and twenty years, v. 270 to 284

Parſley, pinks, and birch, hares are particularly fond of, iv. 7

Partridges, in England, a favourite delicacy at the tables of the rich, whoſe deſire of keeping them to themſelves, has been gratified with laws for their preſervation, no way harmonizing with the general ſpirit of Engliſh legiſlation, and why—there are two kinds, the grey and the red; the grey is moſt prolific, and always keep on the ground; the red leſs common, and perches upon trees—the partridge is found in every country and climate—in Greenland, where it is brown in ſummer, becomes white in winter—thoſe of Barakonda are larger legged, ſwifter of foot, and reſide in the higheſt rocks—partridges of all ſorts agree in one character, being immoderately addicted to venery; often to an unnatural degree—the male purſues the hen to her neſt, and breaks her eggs, rather than be diſappointed—the young having kept in flocks during the winter, break ſociety in ſpring, when they begin to pair; and terrible combats enſue—their manners otherwiſe reſemble thoſe of poultry, but their cunning and inſtincts are ſuperior—means the female uſes to draw away any formidable animal that approaches her neſt—the covies from ten to fifteen, and, unmoleſted, they live from fifteen to ſeventeen years—method of taking them in a net with a ſetting-dog, the moſt pleaſant, and moſt ſecure—they are never ſo tame as our domeſtic poultry, v. 207 to 211

Paſſions, moſt of the furious ſort characterized from the elevation and depreſſion of the eye-brows, ii. 84—freedom from paſſions not only adds to the happineſs of the mind, but preſerves the beauty of the face, 198

Paſtures, thoſe of Great Britain excellently adapted to quadrupedes of the cow kind, iii. 9

Patas, by ſome called the red African monkey—its deſcription, iv. 233

Paul, (St.) in Lower Brittany. See *Sand*, i. 364

Paunch, name of the firſt ſtomach of ruminating animals, iii. 3

Pazan, name of the eighth variety of gazelles, by Mr. Buffon, iii. 74

Peacock, a ſaying among the ancients, as beautiful as is the peacock among birds, ſo is the tiger among quadrupedes, iii. 233—varieties of this bird—ſome white, others creſted—that of Thibet, the moſt beautiful of the feathered creation—our firſt were brought from the Eaſt Indies; and they are ſtill found in flocks in a wild ſtate in the iſlands of Java and Ceylon—the common people of Italy ſay it has the plumage of an angel, the voice of a devil, and the guts of a thief—in the days of Solomon, we find his navies imported from the Eaſt apes and peacocks—Ælian relates, they were brought into Greece from ſome barbarous country; and that a male and female were valued at thirty pounds of our money—it is ſaid, alſo, that when Alexander was in India, he ſaw them flying wild on the banks of the river Hyarotis, and was ſo ſtruck with their beauty, that he laid a fine and puniſhment on all who ſhould kill or diſturb them—the Greeks were ſo much taken with the beauty of this bird, when firſt brought among them, that it was ſhewn for money; and many came to Athens from Lacedæmon and Theſſaly to ſee it—once eſteemed a delicacy at the tables of the rich and great—Aufidius Hurco ſtands charged by Pliny with being the firſt who fatted up the peacock for the feaſts of the luxurious—Hortenſius the orator was the firſt who ſerved them up at an entertainment at Rome; and they are talked of as the firſt of viands—in the times of Francis I. it was a cuſtom to ſerve up peacocks to the tables of the great, not to be eaten, but ſeen; in what manner they ſerved them—its fleſh is ſaid to keep longer unputrefied than any other—has a predilection for barley; but, as a proud and fickle bird, there is ſcarce any food it will at all times like—it ſtrips the tops of houſes of tiles or thatch, lays waſte the labours of the gardener, roots up the choiceſt ſeeds, and nips favourite flowers in the bud is ſtill more ſalacious than the cock—requires five females at leaſt to attend him; and the number not ſufficient, will run upon and tread the ſitting hen—the peahen, as much as poſſible, hides her neſt from him, that he may not diſturb her ſitting—ſhe ſeldom lays above five or ſix eggs in this climate—Ariſtotle deſcribes her laying twelve—in foreſts where they breed naturally, they are very numerous—this bird lives about twenty years; and not till the third year has that beautiful variegated plumage of its tail—in the kingdom of Cambaya, ſays Taverner, near the city of Baroch, whole flocks of them are in the fields—deſcription of their habits—decoy made uſe of to catch them there, v. 171 to 176

Peacock, (ſea) a name given, and by which has been deſcribed, the Balearic crane, from ſome reſemblance in diſpoſition and manners, v. 388

Peak of Teneriffe, its volcano ſeldom free from eruptions, i. 99

Peak, a noted mountain in the Molucca iſlands, ſeen far off at ſea, ſwallowed by an earthquake, and a lake left where it ſtood, i. 162

Pearl, an animal ſubſtance concreted and taking a tincture from the air—found in all bivalved ſhells, the inſide of which reſemble that ſubſtance called mother-of-pearl—the formation of pearls a diſeaſe or an accident in the animal, is not known—common opinion upon this ſubject—the pearl bred from no diſorder in the animal—*pearl-oyſter*, from which the mother-of-pearl is taken—ſeveral pearl fiſheries—the chief of them in the Perſian Gulph, and the moſt valuable of pearls brought from thence—different ſizes, figures, and colours—whence their different colours proceed—pearls converted by time and damps into a chalky powder—wretched people deſtined to fiſh for pearls—uſually die conſumptive—in what manner they fiſh for them, vii. 53 to 59

Pearls, in ſtags, are parts riſing from the cruſt of the beam, iii. 114

Peaſants, the meaneſt of them in Germany, Poland, and Switzerland kills a cow for his own table, ſalts and hangs up, and preſerves it as a delicacy all the year round, iii. 9

Peccary, or *tajacu*, an animal a native of America, at firſt view reſembling a ſmall hog—its deſcription—has upon the back a lump like the navel in other animals—it conſiſts of glands producing a liquor of an offenſive ſmell—when killed, the parts of generation, and the glands on the back, muſt be taken inſtantly away, otherwiſe in half an hour the fleſh becomes unfit to be eaten—though like the hog in many reſpects, is nevertheleſs a diſtinct race, and will not mix nor produce an intermediate race—is eaſily tamed—goes in herds of two or three hundred, and unites, like hogs, in each other's defence—delights not in marſhes or mud, like our hogs—an unceaſing enemy to the lizard, the toad, and the ſerpent kinds—alſo feeds upon toads and ſerpents—any plunderer ſeizing their young, is ſurrounded, and often killed, iii. 183 to 188

Pedigree, the Arabians preſerve that of their beſt horſes with great care, and for ſeveral generations back, ii. 350

Pegu, a river called the Indian Nile, becauſe of the ſimilar overflowings of its ſtream, i. 218

Pelagii, the Latin name for thoſe ſhells fiſhed up from the deep—thoſe caſt on the ſhore are the littorales, vii. 13

Pelican, a ruminating bird, iii. 5—a native of Africa and America; once known in Europe, particularly in Ruſſia—fabulous accounts propagated of it—the deſcription of it, particularly of its bill, and the great pouch underneath, as wonderful—Tertre affirms the pouch will hide fleſh enough to ſerve ſixty hungry men for a meal—this pouch placed at the top of the gullet, conſidered as the crop in other birds—the deſcription of the bird from father Labat—indolent habits in preparing for incubation, and defending their young—their gluttony ſcarcely to be ſatisfied; their fleſh rancid, and taſtes worſe than it ſmells—uſe made by the Americans of their pouches—is not intirely incapable of inſtruction in a domeſtic ſtate—inſtances of it—Aldrovandus mentions one believed to be fifty years old, vi. 49 to 57

Penguin, union between this bird and the albatroſs, and regularity in their building together, vi. 61—a heavy water-fowl—the wings of this tribe unfit for flight; and their legs ſtill more aukwardly adapted for walking—our ſailors call them arſe-feet—they dive to the bottom, or ſwim between two waters—they never viſit land, but when coming to breed—their colour—

are covered more warmly with feathers than other birds —deſcription of the Magellanic penguin—they unite in them the qualities of men, fowls, and fiſhes—inſtances of its gluttonous appetite—their food and fleſh—are a bird of ſociety—ſeaſon of laying, and manner of making their neſts—ſome of this tribe called by our ſeamen the booby—our men firſt coming among them, were not diſtruſted nor avoided; they ſtood to be ſhot at in flocks, till every one was deſtroyed—the females let them take their eggs without any reſiſtance—the penguin lays but one egg—in frequented ſhores—burrows like a rabbit —three or four take poſſeſſion of one hole, and hatch— one is placed as a centinel to warn of approaching danger, vi. 88 to 95

Peninſula of India, on one ſide the coaſts are near half the year harraſſed by violent hurricanes and northern tempeſts, i. 348—the people there employ the elephant chiefly in carrying or drawing burthens, iv. 278

Penpark-hole, in Glouceſterſhire, twenty-five fathom perpendicular depth—its deſcription, from captain Sturmey, i. 66

People, ſo young as fourteen or fifteen often found to ceaſe growing, ii. 79

Pepper, the Indians prefer that devoured and voided unconcocted by the toucan, before the pepper freſh gathered from the tree, v. 244

Perch, a prickly-finned thoracic fiſh—its deſcription, vi. 302

Perfumes, ſome phyſicians think all perfumes unwholeſome—our delight in perfumes ſeems made by habit, ii. 181—many bodies at a diſtance give an agreeable perfume, and nearer have a moſt ungrateful odour, 182—no perfume has a ſtronger or more permanent ſmell than muſk, iii. 89—the ſcent of the martin a moſt pleaſing perfume, 367—ſome of the weaſel kind have a ſmell approaching to perfume, 380—that of the muſk or the civet, 382—in what manner taken from the pouch —more grateful perfume than muſk—that of Amſterdam the pureſt of any—is communicated to all parts of the animal's body; the fur impregnated, and the ſkin alſo—a perſon ſhut up with one of the ſkins in a cloſe room, cannot ſupport the ſcent—this perfume ſold in

Holland for about fifteen ſhillings an ounce—it has no analogy with the creature's appetite for generation—a proof of it—has its viciſſitudes of faſhion, like dreſs, 391 to 395

Perſepolis, paſtures in the plains about that place excellent for the purpoſes of rearing horſes, ii. 361

Perſia, ſnow falls in abundance upon its mountains, i. 358—the horſes of that country the moſt beautiful and moſt valuable of all in the Eaſt, ii. 361—there are ſtuds of ten thouſand white mares together, with the hoof ſo hard that ſhoeing is unneceſſary, 355—deſcription of the Perſian horſes by Pietro della Valle, 361—the fleſh of the wild aſs ſo much liked that its delicacy is a proverb there, 378—an entertainment of wild aſſes exhibited by the monarch to Olearius, 377, 378—two kinds of aſſes there, and ſome of them worth forty or fifty pounds, ii. 385, 386—a noted country for giving long ſoft hair to the animals bred in it, iii. 212—lions found to diminiſh in number in this country, 215—the bird of Perſia is the common cock of Ariſtophanes, v. 161

Perſian Gulph, a very dangerous wind prevails, by the natives called the ſameyel—it ſuddenly kills thoſe it involves in its paſſage, and frequently aſſumes a viſible form, darting in a blueiſh vapour along the ſurface of the country, i. 358—the poets of Perſia and Arabia have deſcribed it as under the conduct of vengeance, who governs its terrors, and raiſes or depreſſes it, as he thinks proper, 359—the chief pearl fiſhery carried on there, vii. 56—that gulph choaked up in many places with coraline ſubſtances, viii. 192

Perſian kings, wore their whiſkers matted with gold thread, ii. 97

Perſians admire large ege-brows, joining in the middle, ii. 76—divided into two claſſes, tyrants and ſlaves, vii. 58

Perſpiration, an expriment from which the learned may infer upon what foundation the doctrine of Sanctorian perſpiration is built, ii. 110, 111

Peruvians, father Acoſta, and Garcilaſſo de la Vega, make no doubt but that they underſtood the art of preſerving their dead for a long ſpace of time, ii. 273

Peter the Great, czar of Ruſſia, celebrated a marriage of dwarfs, ii. 251—the preparations for this wedding were grand, yet executed in a ſtyle of barbarous ridicule, 252

Petreoleum, an injection of this bituminous oil inwardly, and an application of aſphaltum without, ſuffice to make a mummy, ii. 287

Pettichaps, a bird of the ſparrow kind, v. 314

Phalanger, a kind of oppoſſum—its deſcription—has been called the rat of Surinam, iv. 248

Pharaoh, (the cat of) name given to the ichneumon, iii. 376

Pharaoh, (the capon of) thought to be the true ibis—a devourer of ſerpents, and will follow the caravans to Mecca, to feed upon the offal of animals killed on the journey, v. 385

Phaſis, a river of Colchis, in Aſia Minor, from the banks of which the pheaſants were brought into Europe, and ſtill retain their name, v. 184

Phatagin, an animal leſs than the pangolin—the extent of its tail above twice the length of its body—countries where it is to be found, iv. 124

Pheaſants, at firſt propagated among us, brought into Europe from the banks of the Phaſis, a river of Colchis, in Aſia Minor, whence they ſtill retain their name—Crœſus, king of Lydia, ſeated on his throne, adorned with the barbarous pomp of eaſtern ſplendour, aſked Solon whether he ever beheld any thing ſo fine? Solon replied, that having ſeen the beautiful plumage of the pheaſant, no other finery could aſtoniſh him—deſcription of this beautiful bird—its fleſh the greateſt dainty—animals of the domeſtic kind, once reclaimed, ſtill continue domeſtic, and perſevere in the habits and appetites of willing ſlavery; but the pheaſant, taken from its native warm retreats, ſtill continues his attachment to native freedom; and wild among us, is an envied ornament of our parks and foreſts, where he feeds upon acorns and berries—in the woods the hen pheaſant lays from eighteen to twenty eggs in a ſeaſon; but in a domeſtic ſtate ſeldom above ten—when wild, ſhe hatches and leads up her brood with patience, vigilance, and courage; but when tame ſhe never ſits well; and a common hen becomes her ſubſtitute; and for leading her young to their food, ſhe is utterly ignorant where it is found—and the young would ſtarve if left ſolely to her management—it is better left at large in the woods than reduced to its priſtine captivity—its fecundity, when wild, is ſufficient to ſtock the foreſt, and its fleſh acquires a higher flavour from its unlimited freedom—its habits, when tame—no birds are ſhot more eaſily—when phyſicians of old ſpoke of wholeſomeneſs of viands, the compariſon lay with the fleſh of the pheaſant—theſe birds taken young into keeping, become as familiar as chickens; and when deſigned for breeding, they are put together in a yard, five hens to a cock—the neſt in their natural ſtate—the female refuſing to hatch the eggs, a common hen ſupplies her place, and performs the taſk with perſeverance and ſucceſs—the young difficult to be reared—with what food the young muſt be ſupplied—particularities concerning the rearing of the young ones—the method of Longolius, to encreaſe the breed and make it more valuable—the pheaſant will at laſt be brought to couple with a common hen—many varieties of pheaſants; of all others, the *golden pheaſant* of China the moſt beautiful, v. 184 to 190

Phlegium, one of the higheſt mountains of Ethiopia, ſwallowed by an earthquake, i. 162

Pholas, the file-fiſh, places where theſe animals are found—their power of penetrating—the pillars of the temple of Serapis at Puteoli were penetrated by them—they pierce the hardeſt bodies with their tongue—their motion ſlow beyond conception—have no other food but the ſea-water—are accounted a great delicacy, vii. 65 to 70

Pichincha, a remarkable mountain, near Quito, in South America, i. 151

Pie, in the claſs of the pie-kind, few, except the pigeon, are of uſe to man; yet, to each other, no claſs of birds ſo ingenious, active, and well-fitted for ſociety—they live in pairs, and their attachments are confined to each other—they build neſts in trees or buſhes; the male ſhares in the labour of building, and relieves his mate in the duties of incubation; and the young once excluded, both are equally active in making them ample proviſion—general laws prevail, and a republican form of government is eſtabliſhed among them—they watch for the general ſafety of every bird of the grove—they are remarkable for inſtinct and capacity for inſtruction—inſtances of it, fetching and carrying untaught, all this tribe are but too fond of—their paſſion for ſhining things and ſuch toys as ſome of us put a value upon—rings found in the neſt of a tame magpie—the few general characters in which they all agree, v. 220 to 223

Pie, (ſea) breeds in this country, and reſides in its marſhy parts, vi. 28

Pigeons, bred to a feather, means a diſplay of art by thoſe perſons who employ themſelves in rearing pigeons of different colours, ii. 248—are ruminating birds, iii. 5—thoſe that live in a wild ſtate by no means ſo fruitful as thoſe in our pigeon-houſes nearer home—the tame pigeon, and all its beautiful varieties, owe their origin to one ſpecies, the ſtock-dove—colours of the pigeon in a ſtate of nature—the dove-houſe pigeon breeds every month—the hatching of its eggs—a full explanation of the method of feeding their young from the crop, v. 285 to 289—various names of tame pigeons—attempts made to render domeſtic the ring-dove, but hitherto fruitleſs—the turtle-dove a bird of paſſage—a pair put in a cage, and one dying, the other does not ſurvive—the pigeon called ocotzimtzan is one of the ſplendid tenants of the Mexican foreſts—pigeons of the dove-houſe not ſo faithful as the turtle-dove—two males quarrel for the ſame miſtreſs; and when the female admits the addreſſes of a new gallant, her old companion bears the contempt with marks of diſpleaſure, abſtains from her company, or when he approaches is ſure to chaſtiſe her—inſtances of two males diſpleaſed with their mates, who have made an exchange, and lived in harmony with their new companions—near fifteen thouſand pigeons may in four years be produced from a ſingle pair—the ſtock-dove ſeldom breeds above twice a year—have a ſtronger attachment to their young than thoſe who breed ſo often—the pigeons called carriers uſed to convey letters, not trained with as much care as formerly, when ſent from a beſieged city to thoſe coming to relieve it—in an hour and a half, they perform a journey of forty miles—the only uſe now made of them is to be let off at Tyburn, when the cart is drawn away, v. 285 to 295

Pigmy, exiſtence of a pigmy race of mankind founded in error or in fable, ii. 251

Pigtail is the laſt of the baboons—Mr. Buffon calls it maimon—its deſcription—is a native of Sumatra, not well enduring the rigours of our climate, iv. 215

Pike, the deſcription of this fiſh, vi. 307—poets have called it the tyrant of the watery plain—inſtances of their rapacity, 339

Pilchards, little differing from the herring—make the coaſt of Cornwall their place of reſort—the natives ſometimes encloſe a bay of ſeveral miles extent with nets called ſaines—how directed, ſome years ago, to know where to extend the nets—they take twelve or fifteen hundred barrels of pilchards at a draught—ſerve alſo for manure—advantages of this fiſhery — money paid for pilchards exported has annually amounted to near fifty thouſand pounds, vi. 326 to 328

Pillau, on the Baltic, the ſhores near that place divided into diſtricts for the ſturgeon fiſhery, and allotted to companies of fiſhermen, who rent ſome of them at three hundred pounds a year, vi. 275

Pills, of calcined ſhells and tobacco, uſed by the American Indians undertaking long journies, to palliate hunger, ii. 133

Pilori, one of the three diſtinctions of the muſk-rat—it is a native of the Weſt-India iſlands, iv. 78

Pilot of the ſhark, name given the ſucking-fiſh or remora, and why, vi. 242

Pinch, name of a monkey of the ſagoin-kind—its deſcription, iv. 237

Pinks, hares are particularly fond of them as of parſley and birch, iv. 7

Pintada, or the Guinea hen, its deſcription—different names given to this bird—its habits—the eggs are ſpeckled, v. 192

Pintail, a kind of duck has the two middle feathers of the tail three inches longer than the reſt, vi. 127

Pipal, the Surinam toad, an extraordinary and hideous creature—its deſcription—the young bred and hatched on its back, vii. 108

Pipe of the ſhepherd, the ſtag ſeems delighted with its ſound, iii. 105

Pipe-fiſh, cartilaginous and not thicker than a ſwan-quill—its deſcription, vi. 284

Pipes, conducting water, upon what principle they depend, i. 185—why thoſe in London are extremely apt to burſt, 186

Piper-worms, and other little animals, fix their habitations to the oyſter's ſides, and live in ſecurity, vii. 48

Pit falls, a wolf, a friar, and a woman taken in one all in the ſame night--the woman loſt her ſenſes, the friar his reputation, and the wolf his life, iii. 319

Pithekos, name given by the ancients to the ape properly ſo called, iv. 206

Pivot, the razor ſhell, its motion and habits—is allured by ſalt, vii. 52, 53

Placenta, the burden, or that body by which the animal is ſupplied with nouriſhment, ii. 40, 41

Plague, not well kuown whence it has beginning—is propagated by infection—ſome countries, even in the midſt of Africa, never infected with it—others generally viſited by it once a year, as Egypt—not known in Nigritia—Numidia it moleſts not once in a hundred years—plague ſpread over the world in 1346, after two years travelling from the great kingdom of Cathay, north of China, to Europe—the plague deſolated the city of London in 1665—its contagious ſteams produced ſpots on the walls—for this laſt age, it has abated its violence, even in thoſe countries where moſt common, and why—a plague affected trees and ſtones, i. 327 to 330

Plaiſne en Anjou, a village in France, particular account of a dwarf born there, ii. 255

Plaiſter of Paris finely powdered boils and heaves in great waves, like water, i. 181

Plantane, preferred by the aſs to every other vegetable, ii. 381

Planets, ſome of them exceed the earth a thouſand times in magnitude—at firſt ſuppoſed to wander in the heavens without fixed paths —perform their circuits with great exactneſs and ſtrict regularity, i. 3—leſſer planets attendants upon ſome of the greater, 5

Plants and vegetables, will not grow ſo faſt in diſtilled as undiſtilled water, i. 167—ſmell of ſome ſo powerful as hardly to be endured, 219—plants, ſubmarine, corals and other vegetables, covering the bottom of the ſea, 289—do not vegetate in an exhauſted receiver, 315—but thus ceaſing to vegetate, keep longer ſweet than when expoſed to external air, 316—their juices rarefied principally by the ſun, to give an eſcape to their impriſoned air, 338—a certain plant in Ireland ſo ſtrongly affected the perſon who beat it in a mortar, and the phyſician preſent, that their hands and faces ſwelled to an enormous ſize, and continued tumid for ſome time after, 326—compared with animals, ſimilitude—how aſſimilated in different climates and ſoils, ii. 3 to 8—the ſenſitive, that moves at the touch, has as much perception as the freſh-water polypus, poſſeſſed of a ſtill ſlower ſhare of motion, 3—many plants propagated from the depoſition of birds, v. 316. See *Caraguata*, ii. 4 See *Paraſite*, ii. 10.

Plate, or *Plata*, a great river in South America—its ſource and length, i. 216—receives above fifty rivers, 218

Platina, or white gold, the moſt obſtinate of all ſubſtances, i. 74

Plomonecles, the flumide, deſcription of this fiſh, vi. 306

Pleurs en Champagne, a town in France, buried beneath a rocky mountain, i. 158

Pliny, in his arrangements different from the preſent, placed the bats among birds, iv. 134

Plover, the green and grey, are birds of paſſage—the Norfolk plover—ſeaſon of courtſhip, vi. 27 to 30

Plumage of the king-fiſher preſerves its luſtre longer than any other, vi. 144

Pochard, a kind of duck, vi. 127

Poetry, our anceſtors excel us in the poetic arts, as they had the firſt rifling of all the ſtiking images of nature, ii. 266

Pointer, a kind of dog, iii. 286

Poiſon, the moſt deadly poiſons are often of great uſe in medicine, ii. 13—fiſhes often live and ſubſiſt upon ſuch ſubſtances as are poiſonous to the more perfect claſſes of animated nature—that numbers of fiſhes inflict poiſonous wounds, in the opinion of many, cannot be doubted, vi. 342—the many ſpeculations and conjectures to which this poiſonous quality in ſome fiſhes has given riſe, 343, 344—ſome crabs found poiſonous, 370—the ſeat where the poiſon in venomous ſerpents, vii. 194—the ſerpent-poiſon may be taken inwardly, without any ſenſible effects, or any prejudice to the conſtitution—an inſtance of it—if milk be injected into a vein, it will kill with more certain deſtruction than even the poiſon of the viper, vii. 198 to 200. See *Fireflare*. See *New Providence*.

Polar regions, deſcription of them, i. 11, 12—and of the inhabitants round them, ii. 213

Pole-cat, a diſtinct ſpecies from the ermine—reſembles the ferret ſo much, that ſome have thought them the ſame animal—there are many diſtinctions between them—warreners aſſert the pole-cat will mix with the ferret—Mr. Buffon denies it—deſcription of the pole-cat—very deſtructive to young game—the rabbit its favourite prey; and one pole-cat deſtroys a whole warren by a wound hardly perceptible—generally reſide in woods or thick brakes, making holes two yards deep under ground—in winter, they rob the hen-rooſt and the dairy—particularly deſtructive among pigeons—and feaſt upon their brains—fond alſo of honey—female brings forth in ſummer five or ſix young at a time, and ſupplies the want of milk with the blood of ſuch animals as ſhe can ſeize—the fur is in leſs eſtimation than of inferior kinds, and why—an inhabitant of temperate climates, being afraid of cold as well as heat—the ſpecies confined in Europe to a range from Poland to Italy, iii. 358 to 367—pole-cat of America and Virginia are names for the ſqaſh and the ſkink—diſtinctions of thoſe animals, 380, 381—ſeizes the flying-ſquirrel, iv. 36

Poles, trade-winds continually blow from them towards the equator, i. 343, 344—the winter beginning round the poles, the ſame miſty appearance produced in the ſouthern climates by heat is there produced by cold—

the ſea ſmokes like an oven there, 386—limbs of the inhabitants of thoſe regions, ſometimes frozen and drop off, 387—as we approach the north pole, the ſize of the natives proportionably diminiſhes, growing leſs and leſs as we advance higher, ii. 217—the ſtrength of the natives round the polar regions is not leſs amazing than their patience in hunger, 218

Polynemus, deſcription of this fiſh, vi. 304

Polypus very voracious—its deſcription—uſes its arms as a fiſherman his net—is not of the vegetable tribe, but a real animal—examined with a microſcope, ſeveral little ſpecks are ſeen like buds, that pullulate from different parts of the body, and theſe ſoon appear to be young polypi, beginning to caſt their little arms about for prey; the ſame food is digeſted, and ſerves for nouriſhment of both—every polypus has a colony ſprouting from its body; and theſe new ones, even while attached to the parent, become parents themſelves, with a ſmaller colony alſo budding from them—though cut into thouſands of parts, each ſtill retains its vivacious quality, and ſhortly becomes a diſtinct and complete polypus, fit to reproduce upon cutting in pieces—it hunts for its food, and poſſeſſes a power of chuſing it or retreating from danger, ii. 23 to 25—dimenſions of the ſea-polypus, and of that which grows in freſh waters—the power of diſſection firſt tried upon theſe animals to multiply their numbers—Mr. Trembley has the honour of the firſt diſcovery of the amazing properties and powers of this little vivacious creature—this claſs of animals divided into four different kinds by Mr. Trembley—method of conceiving a juſt idea of their figure—manner of lengthening or contracting itſelf—progreſſive motion—an appearance of an organ of ſight found over the whole body—animals of this kind inclined to turn towards the light—their way of living—arms ſerve them as lime-twigs do a fowler—how it ſeizes upon its prey—teſtifies its hunger by opening its mouth—having ſeized the prey, opens its mouth in proportion to the ſize of what it would ſwallow, whether fiſh, fleſh, or inſects—when two mouths are joined upon one common prey, the largeſt ſwallows the antagoniſt; but after laying in the conqueror's body for about an hour, it iſſues unhurt, and

and often in poſſeſſion of the prey, the original cauſe of contention — the cold approaching to congelation, they feel the general torpor of nature, and their faculties are for two or three months ſuſpended—ſuch as are beſt ſupplied ſooneſt acquire their largeſt ſize, but they diminiſh alſo in their growth with the ſame facility, if their food be leſſened — ſome propagated from eggs; ſome produced by buds iſſuing from the body, as plants by inoculation; while all may be multiplied by cuttings to an amazing degree of minuteneſs—of thoſe produced by buds iſſuing from the parent ſtem, ſhould the parent ſwallow a red worm, it gives a tincture to all its fluids, and the young partakes of the parental colour; but if the latter ſhould ſeize upon the ſame prey, the parent is no way benefitted by the capture, all the advantage thus remains with the young—ſeveral young of different ſizes are growing from its body; ſome juſt budding forth, others acquiring perfect form, and others ready to drop from the original ſtem; thoſe young, ſtill attached to the parent, bud and propagate alſo, each holding dependence upon its parent — artificial method of propagating theſe animals by cuttings—Mr. Hughes deſcribes a ſpecies of this animal, but miſtakes its nature, and calls it a ſenſitive flowering plant, 180 to 191

Polypus-coral, the work of an infinite number of reptiles of that kind, viii. 194—in every coralline ſubſtance are a number of polypi, 197

Pomerania, a large part of it covered by the ſea, i. 278

Pongo, name given by Battel to the ouran-outang, iv. 201

Poppies affect with drowſineſs thoſe who walk through fields of them, or are occupied in preparing the flowers for opium, i. 326

Porcelain, an artificial compoſition of earth and water, united by heat, i. 166

Porcupine, as to quills, might be claſſed among the birds, ii. 313—an enlarged hedge-hog—its deſcription, iv. 107—of all thoſe brought into Europe, not one ever ſeen to launch its quills, though ſufficiently provoked—their manner of defence—directs its quills pointing to the enemy—and Kolben relates, the lion then will not venture an attack—feeds on ſerpents and other reptiles—the porcupine and ſerpent are ſaid never to meet without a mortal engagement—how it deſtroys and devours the ſerpent—porcupine of Canada ſubſiſts on vegetables—thoſe brought to this country for ſhew, uſually fed on bread, milk, and fruits; do not refuſe meat when offered—is extremely hurtful to gardens—the Americans, who hunt it, believe it lives from twelve to fifteen years—during the time of coupling, in the month of September, the males become fierce and dangerous, and often deſtroy each other with their teeth—time of their geſtation—the female brings forth one at a time; ſhe ſuckles it about a month, and accuſtoms it to live like herſelf, upon vegetables and the bark of trees—the female very fierce in the defence of her young; at other ſeaſons, fearful, timid, and harmleſs—the porcupine never attempts to bite or any way injure its purſuers—manner of eſcaping, when hunted by a dog or a wolf—the Indians purſue it to make embroidery with its quills, and eat its fleſh—circumſtances concerning it remaining to be known—little known with preciſion, except what offers in a ſtate of captivity—deſcription of one kept in an iron cage—the porcupine of America differs much from that of the ancient continent—two kinds, the couando and the urſon—deſcription of both, iv. 110 to 114

Porcupine of the ſea, deſcribed, vi. 286

Pork, unpalatable with us in ſummer, is the fineſt eating in warmer latitudes, and preferable to hog's fleſh in Europe, ii. 378, 379

Porpus, or *porpeſſe*, a fiſh leſs than a grampus, with the ſnout of a hog—its deſcription and habits, vi. 217—a fiſhery for them along the weſtern iſles of Scotland, in the ſummer ſeaſon, when they abound on that ſhore—live to a conſiderable age, though ſome ſay not above twenty-five or thirty years—ſleep with the ſnout above water—poſſeſs, proportionably to their bulk, the manners of whales—places where they ſeek for prey—deſtroy the nets of fiſhermen on the coaſts of Cornwall—manner of killing them in the Thames—yield a large quantity of oil—the lean, of ſome not old, ſaid to be as well taſted as veal—caviar prepared from the eggs of this fiſh, 221 to 223

Ports choaked up with ſand by the vehemence of the wind, i. 349

Pouch, or bag, the receptacle of the civet, differs in its opening from that of the reſt of the weaſel kind—deſcription of it, iii. 390—of the buſtard, under the tongue, capable of holding near ſeven quarts of water, v. 197—of the pelican, hides as many fiſh as will ſerve ſixty hungry men for a meal, vi. 51—its deſcription, 49, 50

Poultry, general characteriſtics of the poultry kind—they live together; and each, conſcious of his ſtrength, ſeldom tries a ſecond combat, where he has been once worſted—kept in the ſame diſtrict, or fed in the ſame yard, they learn the arts of ſubordination—the young of the kind, not fed with meat put into their mouths, peck their food—the female intent on providing food for her young clutch, and ſcarce takes any nouriſhment at all—among the habits of this claſs of birds, is the peculiarity of duſting themſelves—nearly all domeſtic birds of this kind, maintained in our yards, are of foreign extraction—the courtſhip of this kind is ſhort, and the congreſs fortuitous—the male takes no heed of his offſpring—though timorous with birds of prey, he is incredibly bold among his own kind; the ſight of a male of his own ſpecies produces a combat—the female takes all the labour of hatching and bringing up her young, chuſing a place remote from the cock, v. 153 to 158

Powis Land, in Wales, for many ages famous for a ſwift and generous race of horſes, and why, ii. 370

Powters, a variety of the tame pigeons, v. 293

Pregnancy of ſome women found to continue a month beyond the uſual time, ii. 47—of all animals, in point of time, is proportioned to their ſize, 336—in that ſtate no animals, except the hare, receives the male, iv. 6—the duration in the female of the elephant ſtill unknown, 270

Preſſure, perpendicular in rivers, always in exact proportion to the depth, i. 201

Prey, all the males of theſe birds are a third leſs, and weaker than the females, v. 84. See *Birds*.

Pricket, name hunters give the buck the ſecond year, iii. 128

Primas, appellation of a firſt rate animal—Linnæus beſtows it upon the female of the bat, iv. 138

Propagation of gnats, one of the ſtrangeſt diſcoveries in natural hiſtory, viii. 156—a new kind lately diſcovered in a moſt numerous tribe of animals, propagated by cuttings, 162—different manners of that operation in the polypi, to the aſtoniſhment of the learned of Europe, 187

Propolis, a reſinous gum, with which the bees plaiſter the inſide of their hives, viii. 71

Proportion of the human figure, little known with preciſion in regard to it, ii. 106—different opinions upon the ſubject, 107

Proſpect, ſketch of a delightful African proſpect, on the banks of a moſt dreadful river, i. 220

Provider of the lion, what has given riſe to the jackall's being called ſo, ii. 322—alſo why the ſyaguſh is called by that name, iii. 266

Pſalmodi, in France, an iſland in A. D. 815, now more than ſix miles from the ſhore, i. 277

Ptarmigan, ſort of grous, chiefly found in heathy mountains, and piny foreſts, at a diſtance from mankind—ſize and colour, v. 199

Pthiriaſis, the louſy diſeaſe, frequent among the ancients—principal people who died of this diſorder—plants and animals are infeſted with diſeaſes of this kind—a vegetable louſe from America over-run all the phyſic-garden at Leyden—the leaf-louſe deſcribed—the males have four wings, the females never have any—when they perceive the ant behind them, they kick back with their hind-feet—three principal and conſtant enemies to theſe inſects, vii. 274 to 280

Puffin, or coulterneb, marks that diſtinguiſh this bird—its reſidence—migrations—found by hundreds, caſt away upon ſhores, lean and periſhed with famine—lays one egg—few birds or beaſts venture to attack its retreats—in what manner it defends itſelf againſt the raven—the manks puffin is itſelf one of the moſt terrible invaders—inſtances of it—places which abound with them—in what manner their young are fed—their food

—formerly their fleſh was allowed by the church on lenten days—they bite extremely hard, and keep ſuch hold of what they ſeize, as not eaſily diſengaged—their noiſe, when taken, very diſagreeable, like the efforts of a dumb perſon attempting to ſpeak—quantity of oil in their bodies, vi. 97 to 104

Puget. See *Flies*, viii. 36

Puma, an animal decorated with the name of American lion; though, when compared, ſo contemptible, as to be inferior to that called the American tyger, iii. 232

Purre, a ſmall bird of the crane kind, with a ſhorter bill, and thighs bare of feathers, vi. 22

Puteoli, a city ſwallowed up by an earthquake, had a temple of Serapis, the pillars of which, while under water, were penetrated by the pholas, or file-fiſh, vii. 67

Putrefaction, a new cauſe of animal life—later diſcoveries have induced many to doubt whether animal life cannot be produced merely from thence, ii. 22

Pyramids of Egypt, one of them entirely built of a kind of free-ſtone, in which petrified ſhells are found in great abundance, i. 47

Pyrard, his account of a kind of apes called baris, which properly inſtructed when young, ſerve as uſeful domeſtics, iv. 198

Pygmy of Tyſon, is the ouran-outang, or the wild man of the wood, iv. 189

Pyrites, their compoſition—ſulphur and iron blended and heated with air or water, will form theſe, and marcaſites, i. 77

Q.

Quadrupedes, of all ranks of animated nature, bear the neareſt reſemblance to man, ii. 310—are leſs changed by influence of climate or food, than the lower ranks of nature—ſome are of ſo equivocal a nature, it is hard to tell whether they ought to be ranked in this claſs, or degraded to thoſe below them, 312—inſtances of it, 313—the weaker races exert all efforts to avoid their invaders, 323, 324—next to human influence, the climate ſeems to have the ſtrongeſt effects upon their nature and form, 328—both at the line and the pole, the wild are fierce and untameable, 330—one claſs of theſe entirely left to chance, no parent ſtands forth to protect them, and no inſtructor leads, or teaches them arts of ſubſiſtence; theſe bring forth above two hundred young at a time, 339—America inferior to us in theſe productions—opinion, that all in South America are a different ſpecies from thoſe moſt reſembling them in the old world, 332—ſuch as peculiarly belong to the new continent, are without any marks of the perfection of their ſpecies, 333—their heads different from each other, are adapted to their way of living, and how, 314—the large and formidable produce but one young at a time; while the mean and contemptible are prolific, 334—it has been wiſely ordered ſo by Providence, 335—thoſe that are amphibious have motion in the lower eye-lid alone, 85—of all kinds, none ſo juſtly reproach the natural hiſtorian's inaccuracy, as that which bears the muſk, iii. 88—the moſt untractable, and for its ſize the moſt terrible of all, the hyæna, 343—the largeſt are found in the torrid zone, 28—and theſe are all fond of the water, 29—the change of colour in the hair, obtains in them all to a degree plainly obſervable, 354—it is obſervable, that a thin ſparing diet produces hair, 355—the hog in a wild ſtate moſt delicate in the choice of vegetables, and rejects a greater number than any other animal, 176—the carnivorous have not milk in plenty, 366—are not fond of engaging each other, 369—thoſe that ruminate are harmleſs, and eaſily tamed, 1—they are chiefly the cow, the ſheep, and the deer kind, 5—the chevrotin, or little Guinea deer, the leaſt of all cloven footed animals, and perhaps the moſt beautiful—its deſcription, 82—none can be more beautiful than the tyger, 233—medicines procured from them, 69—ſome formed for the ſurface of the fields, others framed to live upon the tops of trees, and others made to dwell under the earth, iv. 90—of all quadrupedes, the elephant the ſtrongeſt and the largeſt, 254—none that will not breed in its own native climate, except the elephant, under the dominion of man, 269—the mouſe the moſt feeble, and moſt timid of all, except the guinea-pig, 72—they only that migrate from one part of the world to another, are the ſeals, 174—none fatter, none more ſleek, or of gloſſy ſkin, than the mole, 91—general deſcription of amphibious quadrupedes, 148

Quail, a bird of paſſage—deſcription of it—time of its migrations—opinion, that it only goes from one part of a country to another—their long journies doubtful—how caught by a call—number of their eggs—fight deſperately at the ſeaſon of courtſhip, and eaſily taken at that time, v. 212 to 214

Quail-fighting, a favourite amuſement among the Athenians—abſtained from the fleſh of this bird, ſuppoſing it fed upon white hellebore—reared numbers of them for fighting, and betted ſums of money, as we do on cocks, v. 214

Quarry of Maeſtricht, i. 63—forty thouſand people may take ſhelter in it—deſcription of it, 64

Quickſilver, remarkable effects of it at the mines near Idra, related by Dr. Pope in the Philoſophical Tranſactions, i. 79—the heavieſt ſubſtance in the world, except gold—floats upon water by a particular experiment, 188—ſeventy-one pounds and a half found equal in bulk to a hundred pound weight of gold, 190

Quills of the porcupine; the Indians embroider with them their belts, baſkets, and ſeveral other neceſſary pieces of furniture—enquiry whether the quills of the porcupine can be ſent off with a ſhake, iv. 112, 113

Quito, in South America, capital city of, one of the moſt charming regions upon earth—this part higher than any other country in the world, i. 150—chace of the wild aſs in that kingdom, ii. 379

R.

Rabbit, have eyes of a red colour, ii. 83—a ruminating animal, iii. 5—rabbit and hare diſtinct kinds—refuſe to mix with each other—inſtance of it—few quadrupedes can overtake the rabbit in a ſhort run, iv. 1, 2—a creature covered with feathers and hair, ſaid to be bred between a rabbit and a hen—their fecundity greater than that of the hare—breed ſeven times a year, and bring eight young each time—love the ſunny field, and open paſture—the female ſuckles the young about a month—the male attends the young, leads them out, and conducts them back—have an external retreat at a diſtance from the warren, as a kind of country-houſe—female brings forth in a part of the warren ſeparate from the male, and digs herſelf a hole, more intricate, at the bottom of which is a more ample apartment—ſome hair ſhe pulls from her belly makes a bed for her young—the male after ſix weeks acknowleges them as his offspring, ſmooths their ſkin, and licks their eyes, 15 to 19

Rabbits (tame) in a warren, continue expoſed to weather, without burrowing—in two or three generations, they find the neceſſity and convenience of an aſylum—various colours of rabbits—the mouſe-colour kinds originally from an iſland in the river Humber—ſtill continuing their general colour, after a number of ſucceſſive generations—account of their production—ſurpriſing obedience and ſubmiſſion of deſcendants to their common parent—the deſcendants quarrelling, his appearance reſtores peace and order—ſometimes he puniſhes them, as an example to the reſt—other inſtances of ſuperiority of the common parent—the rabbit generally fatter, and lives longer than the hare—its fleſh leſs delicate—native of the warmer climates—it has been imported into England from Spain—in ſome of the iſlands of the Mediterranean, they multiplied in ſuch numbers, that military aid was demanded to deſtroy them—love a warm climate—Engliſh counties moſt noted for them—delight in a ſandy ſoil—the tame larger than the wild—indulged in too great plenty of moiſt food, as the feeders expreſs it, are apt to grow rotten—their hair employed in England for ſeveral purpoſes—the ſkin of the male preferred, iv. 19 to 23

Rabbit (Syrian) remarkable for the length, gloſs, and ſoftneſs of its hair, iii. 212—in ſome places curled at the end like wool, and ſhed once a year in large maſſes; and ſome part dragging on the ground, appears like another leg, or a longer tail—no rabbits natural in America—thoſe carried from Europe multiply in the Weſt-India iſlands abundantly—on the continent there are animals reſembling the European rabbits, iv. 23, 24

Rabbit (Braſilian) ſhaped like the Engliſh, but without a tail—does not burrow like ours, and is not above twice the ſize of a dormouſe—Guinea-pig placed by Briſſon among animals of the rabbit kind, iv. 54, 55

Racoon, with ſome the Jamaica rat—its deſcription, and habits—do more injury in one night in Jamaica, than the labours of a month can repair—capable of being inſtructed in amuſing tricks; drinks by lapping, as well as by ſucking—its food, iv. 332 to 334

Rains of blood, the excrements of an inſect at that time raiſed into the air, i. 389

Rainbows, circular rainbows in the Alps, i. 145—and between the tropics, and near the poles, 377—one of the three rainbows ſeen by Ulloa, at Quito, was real, the reſt only reflections thereof—a glaſs globe, filled with water, will aſſume ſucceſſively all the colours of the rainbow—upon the tops of very high mountains, circular rainbows are ſeen, and why—a lunar rainbow, near the poles, appears of a pale white, ſtriped with grey—the ſolar rainbow, in Greenland, appears of a pale white, edged with a ſtripe of duſky yellow, i. 384 to 388

Rain-fowl, the name given in ſome parts of the country to the wood-pecker, and why, v. 249

Rams, it is no uncommon thing in the counties of Lincoln and Warwick, to give fifty guineas for a ram, iii. 44

Ranguer, the name of the ninth variety of gazelles, made by Mr. Buffon, iii. 78

Rarefaction of air, produced by the heat of the ſunbeams in countries under the line, being flat and ſandy, low and extenſive, as the deſarts of Africa, i. 344

Rats, *muſk rat*, three diſtinctions of that ſpecies—the *ondatra*, *deſman*, and *pilori*—the ondatra differs from all others, having the tail flatted, and carried edge-ways—in what they reſemble each other—female of the ondatra has two apertures, one for urine, the other for propagation—they can creep into a hole, where others, ſeemingly much leſs, cannot follow, and why—they reſemble the beaver in nature and diſpoſition—manner of life—their houſes during winter are covered under a depth of eight or ten feet of ſnow—the ſavages of Canada think the muſk rat intolerably fœtid, but deem its fleſh good eating—*great rat*, called alſo *rat of Norway*, though unknown in all northern countries—originally from the Levant, and a new comer into this country—firſt arrival upon the coaſts of Ireland, with ſhips trading in proviſions to Gibraltar—a ſingle pair enough for the numerous progeny now infeſting the Britiſh empire—called by Mr. Buffon the *ſurmalot*—its deſcription—the Norway rat has deſtroyed the *black rat*, or *common rat*, as once called; and, being of an amphibious nature, has alſo deſtroyed the frogs in Ireland—great miſchief done by the Norway rat—it ſwims with eaſe, dives with celerity, and ſoon thins the fiſh-pond—the feebler animals do not eſcape the rapacity of the Norway rat, except the mouſe—they eat and deſtroy each other—the large male keeps in a hole by itſelf, and dreaded by its own ſpecies, as a moſt formidable enemy—produce from fifteen to thirty at a time; and bring forth three times a year—quadrupedes which have antipathies againſt the rat—the *black rat* has propagated in America in great numbers, introduced from Europe, and are become the moſt noxious animal there—its deſcription—*black-water rat*, not web-footed, as ſuppoſed by Ray—its deſcription—its food—is eat, in ſome countries, on faſting days—the nux vomica, ground and mixed with meal, the moſt certain poiſon, and the leaſt dangerous to kill rats—the *German rat*. See *Cricety*, iv. 65 to 80

Rat of Surinam. See *Phalanger*, iv. 248.

Rat of Jamaica, a name by ſome given to the *racoon*, iv. 333

Rattle ſnake, its deſcription, and dimenſions—effects of its bite—the remedies againſt it—power of charming its prey into its mouth—facts related to this purpoſe, vii. 208 to 213—kind of friendſhip between it and the armadilla, or tatou, frequently found in the ſame hole, iv. 131

Ravens, how diſtinguiſhed from the *carrion-crow* and *rook*—manners and appetites—raven found in every region of the world—white ravens often ſhewn, and rendered ſo by art—trained up for fowling like a hawk; taught to fetch and carry like a ſpaniel—to ſpeak like a parrot; and to ſing like a man, with diſtinctneſs, truth, and humour—amuſing qualities, vices, and defects—food in the wild ſtate—places for building neſts—number of eggs—will not permit their young to keep in the ſame diſtrict, but drive them off when ſufficiently able to ſhift for themſelves—three of the Weſtern Iſlands occupied by a pair of ravens each, that drive off all other birds with great cries and impetuoſity—pick out the eyes of ſheep and lambs when ſick and helpleſs—the Romans thought it ominous, and from fear paid it profound veneration—Pliny's account of one kept in the temple of Caſtor, and flew down into the ſhop of a taylor—ſome have lived near a hundred years—in clear weather they fly in pairs to a great height, making a deep loud noiſe, different from their uſual croaking, v. 224 to 230—the horned Indian raven, 235

Ravenna, once ſtood by the ſea-ſide, and is now conſiderably removed from it, i. 276

Ray, his method of claſſing animals, ii. 294

Ray, figure of the fiſh of this kind, and their differences—amazing dimenſions of one ſpeared by negroes at Guadaloupe—to credit the Norway biſhop, there are ſome above a mile over—ſuppoſed to be the largeſt inhabitants of the deep—chuſes its retreat in ſuch parts of the ſea as have a black muddy bottom—the ſmall approach the ſhores—their food—they generate in March and April, when they ſwim near the ſurface of the water, ſeveral males purſuing one female—adhere ſo faſt in coition, that the fiſhermen frequently draw up both together, though only one was hooked—three hundred eggs taken out of the body of a ray—in what manner the eggs drop into the womb from the ovary, or egg-bag—breeding ceaſes in October, and in May are in higheſt perfection—account of the method of taking them, vi. 244 to 250—all extremely delicate in their choice of baits; a piece of herring or haddock twelve hours out of the ſea, and then uſed as a bait, they will not touch—beſt weather for taking them—method uſed by the Italians in the Mediterranean to take this fiſh—they bait a line of twenty miles long, with ten or twelve thouſand hooks—no way of ſeizing the rough ray, but by the little fin at the end of the tail, vi. 253 to 255

Rays of light moderated, and their violence diſſipated by the air, i. 334

Rays of the ſun, darted directly upon the ſurface of the water, compared to ſo many bars of red-hot iron, i. 370

Razor-fiſh, the *coryphæna* of the prickly-finned thoracic kind—its deſcription, vi. 301

Razor-ſhell, the *pivot*, its motion and habits, vii. 52—is allured by ſalt, vii. 53

Reaumur, his chemical elaboratory for hatching chickens, v. 168

Red-breaſt, a ſong bird, ſeemingly mild; claims a diſtrict, whence it ſeldom moves, but drives away every one of the ſame ſpecies without pity, v. 31—its voice has the delicacy of the flute—places where found, 332—its neſt, and the number of eggs, 333

Red-ſtart, bird of the ſparrow-kind, v. 314

Red-wing, or *field-fare*, bird of paſſage—its neſt and eggs, v. 323

Reed, ſtuck into the ground in Perſia, where the earth is impregnated with inflammable vapours, continues to burn like a flambeau, i. 86

Reeve, name given to the female of the *ruff*, vi. 33

Reflection of ſound, its laws not as well underſtood as thoſe of light, ii. 171

Regions, the higheſt region in the world, i. 150—above that of ſtorms, all is calm and ſerene, 353

Rein-deer, killed by eight Engliſhmen upon the coaſt of Greenland, for their ſubſiſtence, remained ſweet eight months, without any ſalt whatever, i. 314, 315. For the deſcription of this animal ſee *Deer*, iii. 149

Relievo, painters can never fully imitate that bold relievo, which both eyes give to the object, ii. 150

Remora, the *ſucking-fiſh*, it ſticks to the ſhark, and drains away its moiſture; the ſeamen believe it attends the ſhark to point out prey; and apprize him of danger; for this reaſon it is called the *ſhark's pilot*, vi. 242

Reproduction. See *Trembley*, viii. 172

Reptiles, grow to a prodigious ſize in the internal parts of South America and Africa, and why, ii. 6 and 332—many of the more humble kinds not only confined to one country, but to a plant; nay, even to a leaf—entirely aſſimilated to the plant they feed on; aſſume its colour, and medicinal properties—taken from that, they inſtantly die—infinite numbers of them not ſeen in this part of the world, and why, ii. 6 to 8

Reſemblance to the common parent of all, the olive-coloured Aſiatic, and the jet-black negroe, claim the honour of hereditary reſemblance to him—argument ſufficing to prove the contrary, ii. 240—difficult to give a reaſon why the child ſhould reſemble the father or the mother, 248

Reſpiration in fiſhes, general method of explaining it, vi. 166—particularly in that of the whale kind, 182

Rhine, a great river, proceeds from the Alps, i. 142—part of it loſt in the ſands, not far from Leyden, 224—the greateſt part arrives at the ocean, 225

Rhinoceros, a ruminating animal, iii. 5—not afraid ſingly to oppoſe the lion, 225—next to the elephant the moſt powerful of animals—general out-line of it—the elephant defeated by it—its horn ſometimes found from three to three feet and an half long—this horn compoſed of the moſt ſolid ſubſtance, and pointed ſo as to inflict the moſt fatal wounds—fabulous reports of this animal—deſcription of its tongue by L'Avocat—a rhinoceros ſent from Bengal to London, not above two years old, coſt near a thouſand pound for his conveyance and food—how it was fed—of a gentle diſpoſition, permitted itſelf to be touched and handled by all viſitors, attempting no miſchief but when abuſed, or hungry; no method of appeaſing its fury then but by giving it ſomething to eat—when angry, it jumped againſt the walls of the room with great violence—its age—its food—places where found—in ſome parts of Aſia, theſe animals are tamed, and led into the field to ſtrike terror into the enemy, but are as dangerous to the employers—method of taking them—ſome found in Africa with a double horn, one above the other—many medicinal virtues aſcribed to this horn, when taken in powder, without any foundation, iv. 285 to 291

Rivers, all our greateſt find their ſource among mountains, i. 142—their production according to De la Hire, 194—other hypotheſes upon the ſame ſubject, 196—the copious fountains of the greateſt moſt remote from the ſea, 198—channels of rivers originally formed by the induſtry of man, according to Varenius, 200—make their own beds, and level the bottom of their channels—rivers dig and widen themſelves, to a certain degree—their banks appear above water, after inundations, when the adjacent valley is overflown, and why—their ſinuoſities and turnings more numerous as they proceed —a certain ſign with the ſavages of North America, they are near the ſea, when they find the rivers winding and often changing their direction—rivers riſe in the middle, and the convexity is in proportion to the rapidity of the ſtream—when tides flow up with violence againſt the natural current, the greateſt rapidity is then found at the ſides of the river, and why—at theſe times, the middle waters ſink in a furrow—a little river received into a large, without augmenting either width or depth, and why—inſtance of it—a river tending to enter another either perpendicularly or in an oppoſite direction, will be diverted by degrees from that direction, and obliged to make itſelf a more favourable entrance with the ſtream of the former—the union of two rivers into one makes a ſwifter flow, and why—whatever direction the ridge of the mountain has, the river takes the oppoſite courſe, i. 201 to 208—their branches compared to a number of roots conveying nouriſhment to ſtately trees—equally difficult to tell which the original, 217—every great river, whoſe ſource lies within the tropics, has its ſtated inundations, 218—thoſe of countries leaſt inhabited are very rocky and broken into cataracts, and why, 221—ſome loſe themſelves in the ſands or are ſwallowed up by chaſms in the earth—at the poles neceſſarily ſmall, and why—the rivers of Europe more navigable and more manageable than thoſe of Africa and the torrid zone—all rivers in the world flowing into the ſea with a continuance of their preſent ſtores, would take up, at a rude computation, eight hundred years to fill it to its preſent height, i. 224 to 228

Robin-red-breaſt, a ſlender-billed bird of the ſparrow-kind, living upon inſects, v. 314

Rock, great bird, deſcribed by Arabian writers, and exaggerated by fable, ſuppoſed to be but a ſpecies of the condor, between the eagle and vulture, v. 105

Rocks and precipices, thoſe of St. Kilda are more than three quarters of a mile perpendicularly—deſcription of a very bold coaſt, vi. 76

Roe-buck, the ſmalleſt of the deer-kind in our climate—its deſcription—differs from the fallow-deer, from the ſtag, and from all the goat-kind—faces the ſtag, and often comes off victorious—theſe bucks live in ſeparate families; the ſire, dam, and young aſſociate, and admit no ſtranger into their community—never leaves its mate—rutting ſeaſon continues but fifteen days, from the end of October to the middle of November—female goes with young five months and a half—produces two at a time, and three rarely—her tenderneſs in protecting them very extraordinary—names given by hunters to the different kinds and ages of it—time of ſhedding its horns—its life ſeldom longer than twelve or fifteen years; and tame, not above ſix or ſeven—is of a delicate conſtitution—eaſily ſubdued, but never thoroughly tamed its cry neither ſo loud nor ſo frequent as the ſtags—hunters eaſily imitate the call of the young to the dam, and thus allure her to deſtruction—this animal contented to ſlake its thirſt with the dew on the graſs and leaves of trees—prefers tender branches and buds of trees to corn and other vegetables—we have but two known varieties—the fleſh of thoſe between one and two years old the greateſt delicacy known—more common in America than in Europe—inhabitants of Louiſiana live upon its fleſh, which taſtes like mutton when well fatted—the breed extremely numerous, and the varieties in proportion—found alſo in Braſil, where called cuguacu-apara; and in China—its deſcribers there confound it with the muſk-goat, though of a different nature, iii. 131 to 140

Roger de Belegme, the firſt recorded for attempts towards mending our native breed of horſes, ii. 370

Roger of Sicily. See *Silk Manufacture*, viii. 50.

Roller, a beautiful bird of the pie-kind; its deſcription, v. 242

Romans cut down all the woods and foreſts in Britain, and why, i. 286—in battle, opened their ranks to admit the elephant, and ſeparating it from aſſiſtance compelled its conductors to calm its fury and ſummit, iv. 277—the vanity of their boaſts beſt ſhewn by the parrot-kind, in a hundred ſpecies now known, not one of thoſe birds naturally breeds in any of the countries that acknowledged the Roman power, v. 283—a Roman emperor had fifteen hundred flamingos tongues ſerved up in a ſingle diſh at a feaſt, vi. 15—a Roman ſenator uſed to throw into his ponds ſuch of his ſlaves as offended him, to feed the lampreys, vi. 270—infamous for a Roman to appear in a dreſs, in which ſilk entered into the compoſition, viii. 49

Rombald, a holy temperate man ſaid to have lived a hundred and twenty years, chearful by ſtrong hopes, and healthy by moderate labour, ii. 132

Rooks, of the pie-kind; not carnivorous—places where they build their neſts—their plan of policy—young couples making neſts too near an old pair, a battle enſues, and the old become victorious—fatigues of the young in making neſts—the female beginning to lay, all hoſtilities ceaſe, and ſhe is ſuffered to hatch her brood without moleſtation—a foreign rook attempting to join ſociety with them, would have the grove in arms againſt him, and be expelled without mercy—their chief food, v. 230 to 235

Roſes, otter of roſes, a modern delicate perfume, iii. 394

Rouſette, the great bat of Madagaſcar, a formidable creature, deſcribed, iv. 141—drinks the juice of the palm-tree, 142

Royſton-crow, a bird of paſſage, deſcribed, v. 230

Rubeth, the land-toad, the only one of the kind that has the property of ſucking cancerous breaſts, vii. 105

Ruff, ſmall bird of the crane-kind—manner of taking it—their fleſh in high eſtimation, vi. 33, 34

Ruminant animals—ruminant quadrupedes, birds, fiſhes, inſects—men known to ruminate; inſtance in a young man at Briſtol, iii. 6—thoſe of the cow-kind hold the firſt rank, 8—all of this claſs internally much alike, 36—have not the upper fore-teeth, 44—the ſtag performs this with more difficulty than the cow or ſheep, 106. See *Animal*, iii. 1 to 7

Runer,

Runner, the corrira, bird of the crane-kind, its deſcription, vi. 20

Runts, a variety of tame pigeons, produced by croſs-coupling, v. 293

Ruſſian ſoldiers and condemned criminals ſent into Siberia to kill ſables, both taxed at a certain number of ſkins yearly—a colonel, during ſeven years ſtay, gains about four thouſand crowns for his ſhare, iii. 375

Ruſt, copper and iron quickly covered and corroded with it—gold contracts no ruſt, and why, except in the elaboratories where ſalt is much uſed, i. 313

Rut, time when the ſtag feels the deſire of copulating, iii. 101—their neck is then ſwoln—other effects which it cauſes in ſtags, 102—their voice at that time terrible, 106

S.

Sable, its deſcription, from Mr. Jonelin, the firſt accurate obſerver of this animal—ſables leap with eaſe from tree to tree, and are afraid of the ſun—different colours of their fur—hunting the ſable chiefly the lot of ſoldiers and condemned criminals—how directed to ſhoot them, iii. 373 to 375

Sabre, the trachepterus, deſcription of this ſpinous fiſh, vi. 303

Sacre, bird of the generous breed of hawks, the legs are of a blueiſh colour, and ſerve to diſtinguiſh it, v. 121

Sago tree eat by the elephant to the ſtump, iv. 259

Sai, the bewailer, a monkey of the new continent, iv. 236

Sail, a ſtag hard hunted, taking to the water, is ſaid to go ſail, iii. 114

Saines, names of the nets uſed in the pilchard-fiſhery on the coaſt of Cornwall, vi. 326

Sajou, third ſort of the ſapajou, a monkey of the new continent, iv. 236

Saki, the cagui, the largeſt monkey of the ſagoin kind—its deſcription, iv. 237

Sal ammoniac, made of the urine of camels, iv. 311

Salamander, there is no ſuch animal exiſting as that deſcribed by the ancients — the modern ſalamander a lizard—its conformation and habits—reports concerning their venom—idle notion of its being inconſumable in fire—internal conformation of the lizard—manner of its bringing forth young alive, all amphibious—ſuſtain want of food ſurpriſingly, vii. 139 to 146

Salmon, ſaid to be a ruminating fiſh, iii. 5—a ſoft-finned abdominal fiſh, vi. 307—the young continue in the egg from the beginning of December till the beginning of April, 176

Salt water, opinions about the ſaltneſs of the ſea, particularly that of Boyle—method of finding out the age of the world by the ſaltneſs of the ocean—ſaltneſs found to prevail in every part of the ocean, as much at the ſurface as at the bottom—alſo found in ſome lakes—conſidered as a principal cauſe in preſerving the ſea from putrefaction—it is confirmed by experiments—advantages derived from the ſaltneſs of the ſea—various attempts to make it freſh—its weight, i. 234 to 241

Salt, Bay-ſalt, brought from the Bay of Biſcay, a ſtrong kind made by evaporation in the ſun, i. 241—fiſhes do not imbibe any of the ſaltneſs of the ſea-water, vi. 315—deſtroys ſnails, vii. 25—allures the pivot, or razor-ſhell, 53—ſalt ſprinkled upon the water lizard, the whole body emits a viſcous liquor, and it dies in three minutes, in great agonies, 146—volatile cauſtic ſalt obtained in great quantity from the cantharides fly, viii. 143

Samiri, the aurora, the ſmalleſt and moſt beautiful monkey of the ſapajou kind—its deſcription—a very delicate animal, and held in high price, iv. 236

Samoeid Tartars, deſcription of that people, ii. 213

Sanctorian ſtatical experiments upon a weak foundation, ii. 111

Sand, rolling in waves like a troubled ſea, and overwhelming all with inevitable deſtruction, i. 13—fine vitrifiable, found in a well dug at Marly, 57—ſo fine, and driven with ſuch violence, as to penetrate into cheſts, be they ſhut never ſo cloſely, 357—tract of a country, lying along the ſea-ſide in Lower Brittany, inhabited before the year 1666, now lies deſert, being covered with ſand to the height of twenty feet, 364

Sanderling, ſmall bird of the crane-kind, vi. 22

Sandpiper, ſmall bird of the crane-kind, vi. 22

Santorin, an earthquake happened in it in 1707, i. 126—the new volcano near it, 127

Sapajou, name given to the monkies of the new continent, that have muſcular holding tails—five ſorts of them, iv. 235

Savages more difficult in point of dreſs than the faſhionable or tawdry European, ii. 98—inſtance of it, 97—perform a journey of twelve hundred leagues in leſs than ſix weeks, 115—oblige their women to a life of continual labour—is ſurpriſed a European walks forward for his amuſement and return back again, 121—the boaſt of corporal force now reſigned to ſavage nations, and why, 119—are highly delighted with the ſmell of aſafœtida, 181—their cuſtoms in every country almoſt the ſame, 230—thoſe of Africa the moſt brutal—they and thoſe of America, ſuppoſe monkies to be men, idle, ſlothful, rational beings, capable of ſpeech and converſation, but obſtinately dumb for fear of being compelled to labour, iv. 231

Sauce made with the blood and marrow of the reindeer, and kept for uſe in ſmall caſks by the Laplanders, iii. 167

Savoyards, the only chimney-ſweepers of Paris carry about for ſhow the marmotte, bred in their native country, iv. 39

Scallop, in its ſhell, moves forward upon land, and ſwims upon the ſurface of the water, by contrivance in a ſingular manner, vii. 51

Scar, a child diſtinctly marked ſimilar to one the father had from a wound received in battle, ii. 238

Scarus, if we believe Ovid, is, like the ſalmon, a ruminating fiſh, iii. 6

Scaup-duck, a variety of the duck-kind, vi. 127

Scent, the negroes of Guinea have an inſupportable ſcent, ii. 226

Schottus aſſures us, he ſaw an inſtance of fiſhes being allured by muſic, ii. 168

Sciæna, a ſpinous fiſh—deſcription of this fiſh, vi. 302

Scolopendra, the centipes, a hideous angry worm, deſcribed, vii. 302, 303

Scomber, the mackarel, a prickly-finned thoracic fiſh—its deſcription, vi. 301.

Scorpæna, or father-laſher, of the prickly-finned thoracic kind—deſcription of this fiſh, vi. 302

Scorpion, four principal parts diſtinguiſhable in this animal—the reſervoir where its poiſon is kept—effects of its ſting upon a dog, in an experiment made by M. Maupertuis—experiments made upon other dogs—inſtances of its iraſcible nature and malignity—when driven to extremity, deſtroys itſelf—inſtance of it—the male ſmaller than the female—their chief food—how the common ſcorpion produces its young—captivity makes it deſtroy its young—a ſcorpion of America produced from the egg, vii. 292 to 301

Scorpion, (water) an inſect with wings, deſcribed—its habits, vii. 359, 360

Scoter, an European duck, vi. 126

Scotland has land in it at one time covered with water, at another free, i. 279—not infeſted with wolves, iii. 319

Scotchman, in the Tower for felony, took not the leaſt ſuſtenance during ſix weeks, the records of that fortreſs mentioning his being exactly watched all that time, ii. 132

Sea was open to all till the time of the emperor Juſtinian, i. 232—ſenſibly retired in many parts of the coaſts of France, England, Holland, Germany, and Pruſſia, 275—Norwegian ſea has formed ſeveral little iſlands from the main land, and ſtill daily advances upon the continent, 278—its colour not from any thing floating in it, but from the different reflexions of the rays of light—a proof of it—though its ſurface be deformed by tempeſts, it is uſually calm and temperate below—the ſea grows colder in proportion as divers deſcend, 292, 293—ſmokes like an oven near the poles, when the winter begins, 386—no fiſh imbibe any of the ſea-ſaltneſs with food or in reſpiration—why ſome ſpecies live only there, and expire when brought into freſh water, accounted for, vi. 315

Sea (Red) choaked up with coraline ſubſtances, i. 288—along ſome ſhores, and at the mouths of ſeveral rivers, the bottom has the appearance of a foreſt of trees, millions of plants ſtanding ſo thick as to obſtruct navigation, viii. 192

Sea-eggs, name given to the multivalve ſhell fiſh, of the echini, or urchins, which move, vii. 61

Sea-nettles, name given by ſome to the ſtar-fiſh, viii. 175

Sea-water, various methods propoſed to render it freſh for the uſe of ſeamen in long voyages, i. 237—about a forty-fifth part heavier than freſh water, 241—is heavier, and conſequently ſalter, the nearer we approach the line, 242. See *Salt water*.

Sea-worm may be multiplied by being cut in pieces, ii. 23. See *Polypus*.

Seal reſembles a quadrupede in ſome reſpects, and a fiſh in others, ii 313 and iv. 168—its deſcription—the varieties innumerable—the brain largeſt of any animal—its tongue differs from other quadrupedes—the foramen ovale in its heart never cloſing, fits it for continuing under water, though not ſo long as fiſhes—the water its habitation, and any fiſh its food—makes little uſe of its legs—ſeldom at a diſtance from the ſhore—found in the North and Icy Seas, and on thoſe ſhores in flocks, baſking on the rocks and ſuckling their young—alarmed, they plunge all together into the water—in thunder and torrents they ſport along the ſhore, as delighted with univerſal diſorder—gregarious and migrant, direct their courſe to northern coaſts and ſeas free of ice, in two departures, obſerving time and track, iv. 168 to 174—how and by what paſſages they return unknown—they go out fat and return lean—females in our climate bring forth in winter—where they rear their young—how they ſuckle them—ſhe has four teats near the navel—in fifteen days, ſhe brings the young to the water, to ſwim and get food—no litter exceeds four—the young know the mother's voice among the bleatings of the old—aſſiſt each other in danger, and are obedient to her call—hunt and herd together, and have a variety of tones like dogs and cats, to purſue prey, or warn of danger—feeling natural deſires, they fight deſperately, and the victorious male keeps all to himſelf—two never fall upon one, each has its antagoniſt—neither length of time in pregnancy, nor duration of theſe animals lives yet known—two taken young, after ten years had the marks of age—expert at catching fiſh—deſtroy herrings by thouſands—ſwift in deep waters, they dive with rapidity—attacked with ſtones, they bite at what is thrown, and to the laſt gaſp annoy the enemy—time to ſurpriſe them—how the Europeans and Greenlanders deſtroy them—in our climate they are wary, and ſuffer no approach—never ſleep without moving, and ſeldom more than a minute—taken for the ſkin and oil the fat yields—uſes of the ſkin when dreſſed—the fleſh formerly at the tables of the great—an inſtance of it—the ſea-lion, in Anſon's Voyages, the largeſt of the ſeal family, iv. 175 to 180

Seeds, ſome thought to thrive better for maceration in the ſtomach of birds, before they be voided on the ground, v. 316

Senegal, a river in Africa, its courſe—is navigable for more than three hundred leagues, i. 212—receives more than twenty rivers, 217—the natives conſider forty years as a very advanced time of life, and generally die of old age at fifty, 321

Senſations, their illuſion at firſt when man is newly brought into exiſtence, deſcribed by Mr. Buffon, ii. 187—fiſh fall behind terreſtrial animals in their ſenſations, vi. 155

Senſes, acting at ſome diſtance, proportionably more capable of making combinations; and conſequently, more improveable, ii. 178—of all ſenſes man is moſt inferior to that of other animals in that of ſmelling—and it ſeems not to offend them, 179—the groſſeſt, and moſt uſeful of all, is that of feeling, 185

Senſitive plant, has as much perception as the freſh water polypus, ii. 3

Seps, improper name of the Chalcidian lizard, the laſt diviſion of that kind—deſcription of this animal, vii. 157, 158—its bite very venomous, 215

Seraglio, to be able to furniſh one the only tendency of the ambition of an Aſiatic, ii. 72

Serpents, the ſea about the iſlands of Azores repleniſhed with them for want of motion, i. 239—the various hiſſings at the cloſe of evening make a louder ſymphony in Africa than birds in European groves in a morning, ii. 321—to believe all ſaid of the ſea-ſerpent, is credulity; to refuſe aſſent to its exiſtence, is preſumption, vi. 189—the natural food of the ichneumon, iii. 379—the only animal in the foreſt that oppoſes the monkey—ſurpriſing them ſleeping, ſwallows them whole, before they have time for defence—monkies inhabit the tops of trees, and ſerpents cling to branches toward the bottom; thus near each other, as enemies in the ſame field of battle—this vicinity thought to argue a friendſhip—monkies provoke the ſerpents by jumping over them, iv. 220—ſea-ſerpent, the elops deſcribed, vi. 304—hiſtories of antiquity exhibit a nation ſinking under the ravages of a ſerpent, vii. 162—Regulus leading his army along the banks of the river Bagrada, in Africa, an enormous ſerpent diſputed the paſſage, its ſkin was an hundred and twenty feet long, 163—marks diſtinguiſhing them from the reſt of animals—their conformation, 165—and progreſſive motion, 171 — encounter of a great ſerpent with a buffalo — entwines and devours the buffalo, 174—long ſerpent of Congo, 176—ſome bring their young alive, ſome bring forth eggs—ſome venomous, and ſome inoffenſive—animals which deſtroy them—boaſted pretenſions of charming ſerpents—have docility —Egyptians paid adoration to a ſerpent; and inhabitants of the weſtern coaſt of Africa retain the ſame veneration, vii. 182 to 190—all amphibious—their motion, ſwiming in liquids—excrements of ſome kept as a pleaſing perfume at Calcutta and Cranganon—the Eſculapian ſerpent—little ſerpent at the Cape of Good Hope, and north of the river Senegal, 172—the prince of ſerpents a native of Japan, the greateſt favourite of ſavages, and has not its equal for beauty, vii. 224—ſeat of poiſon in venomous ſerpents; inſtrument by which the wound is made—thoſe deſtitute of fangs are harmleſs— various appearances the venom produce—may be taken inwardly without ſenſible effects or prejudice to the conſtitution—inſtance of it—another of the force of ſerpents poiſon, from Ray, vii. 193 to 200—no animals bear abſtinence ſo long, 178 — their powers of digeſtion but feeble, 179 — their principal food birds, moles, toads, lizards, 202—little ſerpents live for ſeveral years in glaſſes, never eat at all, nor ſtain the glaſs with excrements, 179

Serval, a native of Malabar, reſembling the panther in its ſpots, iii. 258

Setter, a dog of the generous kind, iii. 286, 288

Severn, lamprey of this river the moſt delicate of all fiſh, vi. 266

Shagreen, made of the ſkin of the wild aſs, ii. 377—the ſkin of the ſhark, by great labour, poliſhed into the ſubſtance called ſhagreen, vi. 243

Shammoy, a kind of goat, in the mountains of Dauphiné, Piedmont, Savoy, Switzerland, and Germany—its deſcription—keep in flocks from four to fourſcore, and a hundred—time of coupling—live twenty or thirty years—their fleſh good to eat; the ſuet from ten or twelve pounds—this animal has a feeble bleat, to call its young; in caſe of danger its hiſſing noiſe is heard at a great diſtance—by ſmell, diſcovers a man at half a league—feeds upon the beſt herbage, and delicate parts of plants, and aromatic herbs—admired for the beauty of its eyes—not found in ſummer, except in caverns of rocks, amidſt fragments of ice, or under ſhades of ſpreading trees—during winter, it ſleeps in the thicker foreſts, and feeds upon ſhrubs and buds of pine-trees, and ſcratches up the ſnow for herbage—manner of hunting it—dogs uſeleſs in the chace—ſkin of the ſhammoy when tanned, liked for ſoftneſs and warmth; the leather now called ſhammoy, made from the tame goat, ſheep, and deer—medicinal virtues ſaid to reſide in the blood, fat, gall, and the concretion found in the ſtomach, and called the *German bezoar*, iii. 63 to 69

Shank, the *red*, and the *green ſhank*, varieties of the crane kind—their dimenſions, vi. 22

Shark, deſcription of the great white ſhark—the mouth and throat enormouſly wide; capable of ſwallowing a man, vi. 234—great number of its teeth, 235—no fiſh ſwims ſo faſt—outſtrips the ſwifteſt ſhips—obliged to turn on one ſide (not on the back) to ſeize the prey—inſtances of frightful rapacity in this fiſh—its enmity to man; along the coaſts of Africa, many negroes are ſeized and devoured by them yearly—loves the black men's fleſh better than the white—uſual method of ſailors to take them—no animal harder to kill; when cut in pieces, the muſcles preſerve motion, and vibrate for ſome minutes ſeparated from the body—how killed by the African negroes—the remora, or ſucking-fiſh, ſticks to it; for what purpoſe—for reſemblance to the whale ranked among cetaceous fiſhes—brings forth living young—Rondeletius ſays, the female of the blue ſhark lets her brood, when in danger, ſwim down her throat, and ſhelter in her belly—in Mr. Pennant's opinion, the female is larger than the male, through all this tribe, 236 to 243

Skeat-fiſh, the ſiurus of the prickly-finned abdominal kind—its deſcription, vi. 304

Sheep, their eyes are of a water colour, ii. 83—the author ſaw one that would eat fleſh, 327—proper care taken of the animal produces favourable alterations in the fleeces here and in Syria, 329—ſheep follow the ſound of the ſhepherd's pipe—in courſe of time impoveriſh the paſturage, iii. 10—in the domeſtic ſtate, ſtupid, moſt defenceleſs, and inoffenſive—made ſo by human art alone—its deſcription—thoſe living upon fertile paſture, growing fat, become feeble—thoſe without horns, more dull and heavy than the reſt—thoſe with longeſt and fineſt fleeces moſt ſubject to diſorders—the goat, reſembling them in many other reſpects, much their ſuperior—they propagate together, as of one family, 35—diſtinguiſhed from deer; theſe annually ſhedding the horns, while the permanence in the former, draws an exact line between their kinds, 36—do not appear from old writers to have been bred in early times in Britain—no country produces ſuch ſheep as England, larger fleeces, or better for cloathing—ſheep without horns the beſt ſort, and why—the ſheep in its nobleſt ſtate is in the African deſert, or the extenſive plains of Siberia—ſheep in the ſavage ſtate—the woolly ſheep is only in Europe, and in the temperate provinces of Aſia—tranſported into warmer countries, as Florida or Guinea, loſes the wool and fertility, and the fleſh its flavour—ſubſiſts in cold countries, but not a natural inhabitant of them—the *Iceland ſheep* have four, and ſometimes eight horns, on different parts of the forehead—its wool inferior to that of the common ſheep—with broad tails, common in Tartary, Arabia, Perſia, Barbary, Syria, and Egypt; the tail often weighs from twenty to thirty pounds, and ſometimes ſupported by a ſmall board, upon wheels—thoſe called *ſtrepſicheros*, a native of the Archipelago—Guinea ſheep deſcribed, 38 to 48—they eat three hundred and eighty-ſeven plants, and reject a hundred and forty-one, 176—have eight teeth in the lower jaw—are ſhed and replaced at different periods—ſome breeds in England never change teeth, and are ſuppoſed old a year or two before the reſt—bring forth one or two at a time, ſometimes three or four; the third lamb ſuppoſed the beſt—bear their young five months—and the inteſtines thirty times the length of their body, 210—in Syria and Perſia, remarkable for fine gloſs, length, and ſoftneſs of hair, iii. 212 See *Mouſflon*.

Sheldrake, a variety of the pond-duck, ſuppoſed a native of England, vi. 127

Shells, (foſſil) found in all places near to and diſtant from the ſea, upon the ſurface of the earth, on the tops of mountains, or at different depths, digging for marble, chalk, or other terreſtrial matters, ſo compact as to preſerve theſe ſhells from decay, i. 17—long conſidered as mere productions of the earth never inhabited by fiſh—ſome have not their fellows in the ocean—but all have the properties of animal, not of mineral nature; their weight the ſame with thoſe upon ſhore, anſwer all chemical trials as ſea ſhells do—and have the ſame effects in medicinal uſes—various kinds found a hundred miles from the ſea at Touraine in France—a continued bed of oyſter-ſhells found through the whole circumference of five or five or ſix acres of ground near Reading, in Berkſhire—ſhells found petrified in all the Alpine rocks, in the Pyrenees—on the hills of France, England, and Flanders—a floor, or pavement, of petrified ſhells found in Kent, near the Medway—ſhells always remaining in the deep—eaſier to believe foſſil ſhell bred in freſh water, than that the ſea for a time covered the tops of high mountains—petrified ſhells found in one of the pyramids of Egypt, i. 40 to 50—volumes upon the ſubject of ſhells contribute little to the hiſtory of ſhell-fiſh—methods of conveying a juſt idea of the formation of ſea-ſhells and garden-ſhells—uſual way of accounting for different colouring in ſhells—hint about the operation of nature in colouring ſhells—they aſſume every colour but blue—the animal not ſolely the agent in giving beauty and colouring to it—*ſtairs-ſhell*, or *admiral-ſhell*, not more precious for their ſcarceneſs, than pearls for their beauty—collections of ſhells have their uſe—naturally claſſed by Ariſtotle—places where ſhells are found—and ſubſtances of which they are compoſed—ſuppoſition that all earths fermenting with vinegar, are compoſed of ſhells, crumbled down to one maſs—what ſhells moſt valuable — ſea-ſhells exceed land or foſſil ſhells in beauty—ſome living land ſhells not inferior in beauty to freſh-water ſhells, vii. 2 to 16—great variety of foſſil, or extraneous ſhells—different ſtates of preſervation—every ſhell the ſpoil of ſome animal—no matter how parted from the ſea—Swammerdam's attention to teſtaceous animals almoſt beyond credibility, 15 to 17

Shells of the ſea, ſcarce one met with entire and ſound to the end of its convolutions, and why, vii 34—of all ſea-ſhells, that of the nautilus, the thinneſt and moſt eaſily pierced, 35 — all bivalved ſhells furniſh pearls, and their inſides reſemble and afford that ſubſtance called mother-of-pearl, 53 — ſome pierced by worms argue them food for ſuch animals, 16

Shells, animal, of the armadilla or tatou, one of the moſt ſtriking curioſities in natural hiſtory, iv. 126—turtle-ſhells of an amazing magnitude, vi. 393

Shetland iſles, amazing quantity of herrings appearing off theſe iſlands, vi. 323

Shores, of all thoſe in the world, not one ſo high as that of the weſt of St. Kilda, ſix hundred fathom perpendicular above the ſurface of the ſea, i. 272—ſome on which the ſea has made temporary depredations, 279

Short-heads, name given by ſailors to the young of the whale, whilſt at the breaſt, vi. 196

Shoveller, ſpecies of the crane-kind—its food—inhabitants of the Cape of Good Hope reſpect it as the ancient Egyptians did their bird ibis—its neſt and eggs, vi. 8, 9

Shoulders, high in ſickly perſons—people dying, are ſeen with their ſhoulders drawn up in a ſurpriſing manner, ii. 103—women with child alſo, uſually ſeen high-ſhouldered, 104—ſhoulders, in women, narrower than in men, 107

Showers, dreadful ſhower of hail in 1510—its deſcription, i. 375—of ſtones, fiſhes, and ivy-berries, raiſed into the air by tempeſts in one country, and falling at a diſtance like rain, to aſtoniſh another, i. 389

Siberia, the animal between dog and fox, called iſatis, found in this country, and ſeldom in milder, climates, iii. 340—the ſable reſembling the martin found in this country; ſoldiers and exiled criminals hunt it, and furniſh annually numbers of its ſkins, 375—enormous tuſks found lodged in the ſandy banks of the rivers in this waſte country, iv. 282

Sighs, in what manner produced—when invigorated produce ſobbing, ii. 92

Sight, of old men indiſtinct for bodies cloſe to them, but more preciſe for objects at a diſtance from them, and why, ii. 158—of birds exceeds that of other animals, and excels in ſtrength and preciſion—a kite, from an imperceptible height in the clouds, ſees its prey, and darts on it with unerring aim, v. 10—of birds that prey by day, aſtoniſhingly quick; and in ſuch as ravage by night, ſo fitted as to diſcern objects with preciſion, 80

Signs of death, uncertainty of them ought to make every one cautious of giving up a friend as dead, and expoſing him to real death, or a premature interment, ii. 208 to 210

Silks, brought to Jamaica, and there expoſed to the air, rot while they preſerve their colour, but kept from air retain their ſtrength and gloſs, i. 314—anciently ſo ſcarce in Rome as to be ſold for their weight in gold; and conſidered ſuch a luxurious refinement in dreſs, that infamy was attached to wearing ſtuffs in which it made but half the compoſition, viii. 49

Silk-worm, its real hiſtory unknown among the Romans to the time of Juſtinian; and ſuppoſed only brought into Europe in the twelfth century—two methods of breeding them—Pauſanias's deſcription of this worm—changes of its ſkin in three weeks or a month—gummy fluid forming the threads—preparations made before ſpinning the web—the cone or ball of ſilk deſcribed—efforts to burſt the cone—free from confinement, it neither flies nor eats; the male ſeeks the female, impregnates her in an uninterrupted union of four days, then dies upon ſeparation, ſhe ſurvives till ſhe has laid her eggs, which are hatched into worms the enſuing ſpring—few of theſe animals ſuffered to come to a ſtate of maturity, and why, viii. 50 to 59—the moſt ſerviceable of all ſuch creatures, viii. 4

Silk, (manufactures) eſtabliſhed in Europe, in the beginning of the twelfth century, by Roger of Sicily, viii. 50

Silurus, the ſheat fiſh of the prickly-finned abdominal kind, its deſcription, vi. 304

Simeon, ſaid to have lived an hundred and twelve years, ii. 132

Sinews of the rein-deer, the ſtrongeſt kind of ſewing thread, iii. 167

Single, name of the tail of the ſtag, iii. 113

Siſkin, ſinging bird of the ſparrow-kind, with thick and ſhort bill, feeding on grain and fruit—time of its migration, v. 315, 317

Size of men varies conſiderably—the human body often differs from itſelf—the ſame perſon taller when he riſes in the morning, than going to bed at night; ſometimes the difference is an inch; this firſt perceived in England by a recruiting officer—in what manner—the cauſe of it—men are tall from five feet eight inches to ſix feet high—middle ſize from five feet five to five feet eight, ii. 108 to 110—Maximin, the emperor, above nine feet in height, 118—approaching towards the north pole, the natives diminiſh proportionably, growing leſs and leſs in higher latitudes, 217—cauſe of their difference—an ox, on the fertile plains of India, grows four times as large as the leſſer animal of the ſame kind in the Alps, 237—of men in all ages, nearly the ſame as at preſent—many corroborating proofs of this, 265

Skates, Laplanders make uſe of them upon the ſnow, and how, ii. 215

Skeleton of the bat in ſome meaſure reſembles that of man, iv. 135—ſome human lately diſcovered of enormous ſize five, or ſix feet beneath the ſurface, on the banks of the Ohio, not far from the river Miume, in America, 282

Skin, the only part of the body that age does not harden—whence its wrinkles proceed, ii. 197—of the rein-deer, a more valuable part of the animal than any other—uſes of it, iii. 166—of the tiger, much valued all over the Eaſt, 243—of the black fox moſt eſteemed, a ſingle ſkin ſelling for forty or fifty crowns—the hair is ſo diſpoſed, that it is impoſſible to tell which way the grain lies, 333—moſt valuable part of the martin's ſkin—twelve thouſand of theſe annually imported into England from Hudſon's bay, and thirty thouſand from Canada—moſt worth when taken in the beginning of winter—of all, that of the ſable moſt covered, and held in higheſt price—a ſingle ſkin four inches broad, is often ſold for ten or fifteen pounds—the fur ſurpaſſing all other in having no grain; whatever way rubbed, is equally ſmooth and unreſiſting—a certain number of theſe furniſhed every year by condemned exiles, and Ruſſian ſoldiers, ſent into Siberia to kill the animal, iii. 372 to 375—of the ondatra alſo very valuable, iv. 80—of the mole, Agricola ſaw the fineſt and moſt beautiful hats that could be imagined, made of their ſkins, 98—of the hedge-hog, converted to no uſe, except to muzzle calves, from ſucking, 105—of the elephant, not covered with hair—that part covering the head reſembles the bark of an old tree more than the ſkin of an animal, 265—of the rhinoceros, ſo thick as to turn the edge of a ſcymetar, and reſiſt a muſquet-ball, 286—is naked, rough, knotty, and lying upon the body in folds, after a very peculiar manner, 285—of the oſtrich, what uſe the Arabians make of it, v. 61—of the great Greenland whale, marbled white and yellow, vi. 190—of the civet, ſo ſtrongly ſcented, a perſon ſhut up with one in a cloſe room cannot ſupport the perfume, iii. 392, 393

Skink, an animal called one of the pole-cats of America—the author thinks it Cateſby's Virginia pole-cat—its deſcription, iii. 380, 381

Skull-fiſh, name of the whale above two years old, vi. 196

Slatberg, in Ireland (in the lands of) there ſtood a declivity, and the earth of it was found ſliding down the hill upon the ſubjacent plain, i. 160

Sleep, with ſome lower animals, takes up the greateſt part of their lives—man the only creature requiring ſleep from double motives, for the refreſhment of the mental, and of the bodily frame—want of it produces madneſs—procured to man with more difficulty than to other animals—in what manner ſleep fetters us for hours together, according to Rohault—care required to regulate its quantity, and why—bodily labour demands a leſs quantity of it than mental—the famous Philip Barrettier ſlept twelve hours in the twenty-four—ſleep to ſome an agreeable period of exiſtence—queſtions treated in the ſchools to this purpoſe—numberleſs inſtances of perſons who, aſleep, performed many ordinary duties of their calling; and, with ridiculous induſtry, completed by night, what they failed doing by day—remarkable inſtance related in the German Ephemerides. See *Arlotto*, ii. 133 to 143

Sloth, two different kinds of that animal, the ai and the unan—deſcribed—both ſeem the meaneſt and moſt ill-formed of all animals that chew the cud—their food—formed by nature to climb—they get up a tree with pain, but utterly unable to deſcend—drop from the branches to the ground—move with imperceptible ſlowneſs, baiting by the way—ſtrip a tree of its verdure in leſs than a fortnight, afterwards devour the bark, and in a ſhort time kill what might prove their ſupport—every ſtep taken, ſends forth a plaintive melancholy cry, which, from ſome reſemblance to the human voice, excites a diſpleaſing pity—like birds, have but one vent for propagation, excrement, and urine—they continue to live ſome time after their nobler parts are wounded, or taken away—their note, according to Kircher, an aſcending and deſcending hexachord, uttered only by night—their look piteous, to move compaſſion; accompanied with tears, that diſſuade injuring ſo wretched a being—one faſtened by its feet to a pole, ſuſpended acroſs two beams, remained forty days without meat, drink, or ſleep—an amazing inſtance of ſtrength in the feet inſtanced, iv. 342 to 347

Slot, term for the print of the hoof of the ſtag, iii. 113—to draw on the ſlot, a phraſe among hunters, 114

Slow, name given by ſome to the blind-worm, vii. 222

Smell, no ſubſtance now known in the world has a ſtronger, and more permanent ſmell than muſk, iii. 89—ſtrong offenſive ſmell of foxes often the cauſe of their death, 324—of the weaſel-kind, kept tame about the houſes of the planters in America, not very offenſive, 383—of the genett, not endured by mice and rats, 388—the muſky not properly a characteriſtic mark of any kind of animal, 32

Smelling, the ſenſe in which man is moſt inferior to other animals—it never offends them—ſtronger in nations abſtaining from animal food, than in Europeans—bramins of India have a power of ſmelling, equal to what is in other creatures—can ſmell water they drink, to us quite inodorous—in a ſtate of nature uſeful, not in our ſituation—gives often falſe intelligence—natives of different countries, or different natives of the ſame, differ widely in that ſenſe—inſtances of it—mixtures of bodies void of odour produce powerful ſmells—mixtures of bodies ſeparately diſagreeable, give pleaſant aromatic ſmells—a ſlight cold blunts all ſmelling—incurable averſions to ſmells formerly agreeable, retained from diſorders—ſmalleſt changes in man make great alterations in this ſenſe—antipathies to animals, whoſe preſence is perceived by the ſmell, ii. 179 to 182—delicacy of ſmelling in birds inſtanced in ducks, v. 11.

Savours, mechanical manner of accounting for difference of ſavours, ii. 183

Smile, Fielding aſſerts, a perſon with a ſteady glavering ſmile, never failed to prove himſelf a rogue, ii. 94

Snail, ſhell of the garden-ſnail, in what manner formed, vii. 3, et ſeq.

Snail (ſea) a cartilaginous fiſh, deſcribed, vi. 284

Snail (garden) is ſurpriſingly fitted for the life it is to live—organs of life it poſſeſſes in common with animals; and what peculiar to itſelf—every ſnail at once male and female; and while it impregnates another, is impregnated in turn—coupling of theſe animals—hide their eggs in great numbers in the earth, with great ſollicitude and induſtry—the growth of them—poſſeſſed of the power of mending the ſhell; and come to full growth, they cannot make a new one—Swammerdam's experiment to this purpoſe—their food—ſalt deſtroys them; ſo does ſoot—a tortoiſe in a garden baniſhes them moſt effectually—continue in a torpid ſtate during the ſeverity of winter—ſo great their multiplication in ſome years, that gardeners imagine they burſt from the earth—wet ſeaſons favourable to their production—*ſea-ſnail*, *freſh-water ſnail*, and *land-ſnail*—common garden-ſnail compared with the freſh-water ſnail, and ſea-ſnail—freſh-water ſnails viviporous—bring forth young alive, with ſhells upon their backs—experiment made by Swammerdam to this purpoſe—at all times of the year, freſh-water ſnails opened, are pregnant with eggs, or with living ſnails, or with both together—ſea-ſnails found viviparous, others lay eggs—manner in which the ſea-ſnails impregnate each other—different orifices or verges of ſnails—the difference between land and ſea-ſnails—of the trochus kind, have no mouth—their trunk—are among ſnails, as the tiger, the eagle, or the ſhark, among beaſts, birds, and fiſhes—food of all ſea-ſnails lies at the bottom—of ſea-ſnails, that moſt frequently ſwimming upon the ſurface, whoſe ſhell is thinneſt, and moſt eaſily pierced, is the nautilus—its deſcription—nothing ſeemingly more impoſſible, yet is more certain, than the nautilus ſometimes quitting its ſhell, and returning to it again—peculiarity by which the nautilus is moſt diſtinguiſhed, vii. 19 to 37

Snake, continues for ſeveral months together ſubſiſting upon a ſingle meal, ii. 125—ſnakes deſtroy mice, iv. 73—the only animal in the foreſt adventuring to oppoſe the monkey—larger ſnakes often winding up the trees where they reſide, and happening to ſurpriſe them ſleeping, ſwallow them whole, before they have time to make defence, 220. See *Serpents*.

Snake (black) its deſcription, and food—are oviparous, vii. 220, 221

Snipe, a water-bird of paſſage—its deſcription, vi. 22 to 27

Snow, inhabitants of places where fields are continually white with ſnow, generally become blind before the uſual courſe of nature, i. 15—its melting produces a conſtant breeze, 347

Snow-ſlips, dreaded by travellers—a family in Germany lived for a fortnight beneath one of theſe ſnow-ſlips, i. 161

Sobbing, is a ſigh ſtill more invigorated, ii. 92

Soland gooſe, belongs to the northern iſlands; in greateſt number on the Baſs iſland, and ſubſiſts entirely upon fiſh, vi. 69 to 73. See *Baſs*, and *Gannet.*

Soldier-crab. See *Crab*, vi. 370

Solfatara, a valley near Naples, deſcribed—exhibits the appearance of an earthquake in miniature, i. 123

Sonorous bodies. See *Vibrations*, ii. 164

Soot, as well as ſalt, will deſtroy ſnails, vii. 25

Sore, name the hunters give the buck the fourth year, iii. 128

Sorel, the hunters name for the buck the third year, iii. 128

Sorrel, wood-ſorrel boiled up with milk, by the Laplanders kept in caſks under-ground, to be eaten in winter, iii. 166

Sound, conveyed by air, is loſt in vacuo, i. 334—ſounding bodies of two kinds; unelaſtic returning a ſingle ſound, and elaſtic rendering a ſucceſſion of ſounds—undulations in elaſtic bodies, taken by the ear as one continued ſound, while, in reality, they make many, ii. 163—thoſe whoſe differences can moſt eaſily be compared, are moſt agreeable, 166—thoſe muſical moſt pleaſing, which are moſt unexpected, 167—laws of the reflection of ſound not ſo well underſtood as thoſe of light, 171—perſons of a bad ear often deceived as to the ſide whence ſound comes, 173---trumpets made to encreaſe ſounds, 174

Source, rivers have their ſource in mountains, or elevated lakes, i. 200

Southminſter marſhes ſo over-run with an army of mice, that the graſs was eat up to the roots, v. 148

Spalanzani, his experiments concerning the power of reproduction of animals, viii. 172

Spaniards, the only people of Europe acquainted with the value of the aſs, ii. 385

Spaniels, land and water, the offspring of the beagle, tranſported into Spain or Barbary, ſo altered, and converted there---a dog of the generous kind---the land ſpaniel---the water ſpaniel, iii. 284 to 289

Spaniſh flies, deſcribed; their uſe in medicine, and as bliſters, viii. 141 to 143. See *Cantharis.*

Sparrows, houſe ſparrow---various birds of the ſparrow kind---their food---ſongſters of this claſs---their migrations, v. 314 to 318---a male and its mate, that have young, deſtroy above three thouſand caterpillars in a week, viii. 44

Sparrow-hawk, one of the baſer race of hawks, v. 119—taught to fly at game, but little obtained from its efforts—lately aſſerted, upon reſpectable authority, the boldeſt of all for the pleaſure of the chace, 131

Sparus, the ſea-bream, its deſcription, vi. 302

Spawn, different ſeaſons for fiſh to depoſit their ſpawn, vi. 176—always depoſited in particular places, where the ſun-beams may reach them, 330

Spawning, peculiar preparation of the lamprey for ſpawning, vi. 268

Spears (burning) a peculiar kind of aurora borealis, i. 389

Spears, the horns of the ſtag the third year, iii. 113

Spermaceti, the oil of the cachalot eaſily converted into that concrete, vi. 214—efficacy of ſpermaceti in medicine very ſmall—candles made of it ſubſtituted for wax, and ſold cheaper, 215

Spermaceti whale. See *Cachalot*, vi. 213

Spiders, in South America and Africa, as large as ſparrows, ii. 6—the ſpider, for ſeveral months together, ſubſiſts upon a ſingle meal, 125—chief of our native ſpiders not venomous—their deſcription, and habitudes—the Martinico ſpider's body as large as a hen's egg—manner of making their webs—Liſter has diſtinguiſhed the ſexes of this animal—their coupling—their number of eggs—their bag to depoſit their eggs—their parental care—enemies to each other—experiment made by Mr. Reaumur to turn their labours to the advantage of man—gloves made from their webs—found it impracticable to rear them, vii. 249 to 263

Spiders (water) inhabit the bottom, yet never wet, but incloſed in a bubble of air, ſurrounding them on all ſides, vii. 264

Spinal marrow and the brain, the firſt parts ſeen begun in the embryo, ii. 146

Spinous claſs of fiſhes already extended to four hundred ſorts, vi. 293—Gouan's ſyſtem and arrangement of the various ſorts of ſpinous fiſhes, 299—their general leading marks and difference from others, 311—of thoſe which live in the ocean, the dorado the moſt voracious, 334

Spirits of wine flame with a candle, not with a ſpark, i. 83

Spitzbergen, belief that bodies never corrupt there, nor ſuffer any apparent alteration, though buried for thirty years, ii. 274

Sponges, opinion of count Marſigli about them—that of Rumph and Juſſieu ſet in a clearer light by Mr. Ellis, viii. 193, 194

Spoonbill, deſcriptions of the European and American ſpoonbill—its manner of life, vi. 6, 7

Sports, one peculiar to the Italians, in which horſes without riders run againſt each other, ii. 354—remarkable, on horſeback, among the grandees of Guinea, 363, 364—of wild aſſes, exhibited in Perſia, 377, 378—of the bird-catchers, counterfeiting the cry of the owl, v. 144—of hunting the turkey in Canada, 179. See *Cock*, v. 163

Spouts of water at ſea common in the tropical ſeas, and ſometimes in our own—deſcription of one in the Mediterranean by Tournefort—ſolutions offered for this phœnomenon—broken by guns firing bars of iron at them, which ſtriking them, the water falls from them with a dreadful noiſe, and no farther miſchief—thoſe called typhons, ſometimes ſeen at land, differs from thoſe at ſea deſcribed by mariners—deſcription of that obſerved at Hatfield in Yorkſhire, in 1687—landſpouts ſometimes drop in a column of water at once upon the earth, and produce an inundation—they appear in the calmeſt weather at ſea—facts ſtill wanting to form a rational theory of them, i. 390 to 395

Spout-holes, in the cetaceous tribe, deſcribed, vi. 182

Springs, of water, experience alone can determine the uſeful or noxious qualities of every ſpring, i. 171—one mentioned by Derham, which he never perceived to be diminiſhed in the greateſt drought, when all ponds in the country were dry for ſeveral months, 199

Squaſh, a ſtinkard, of the weaſel kind, called a polecat of America—its deſcription—is ſaid to eat only the brains of poultry—its ſcent ſtrong enough to reach half a mile round, near hand, almoſt ſtifling—a drop of the fœtid diſcharge falling into the eye, might blind it for ever—dogs abate their ardour when they meet the fœtid diſcharge, turn, and leave the ſquaſh maſter of the field, never to be led on again—cows and oxen ſtrongly affected by the ſtench; and proviſions ſpoiled by it—with planters and native Americans, kept tame about their houſes; ſeldom emitting diſagreeable ſcents, except when injured or frighted—natives eat the fleſh, taking care to clear it of the offenſive glands, iii. 380 to 385

Squinting, many inſtances of ſquinting communicated by a father to his offspring, ii. 238

Squirrel, a ruminating animal, iii. 5—claſſed as ſuch by Pierius, iv. 3—the tails are extremely long, beautiful and buſhy, and ſerve them for ſeveral purpoſes—particularly in vaſt leaps of one hundred yards taken from tree to tree—when the animal eats or dreſſes itſelf, it ſits erect, like the hare or rabbit, making uſe of its fore feet as hands—the kind has as many varieties as any wild animal; enumeration of ſome—its way of moving is by bounds—when tamed, is apt to break away at every opportunity—few animals ſo tender, or ſo unfit for a change of abode—ſome live on the tops of trees, others feed on vegetables below, where alſo they take ſhelter in ſtorms—deſcription of its qualities, food, and manſion—the neſt formed among large branches, where they fork off into ſmall—the martin deſtroys the ſquirrel, then takes poſſeſſion of its manſion, 24 to 37

Squirrels are in heat early in the ſpring, very diverting to ſee the female then feigning an eſcape from the purſuit of two or three males—nature particular in the formation of theſe animals for propagation—time of geſtation—keeps in the midſt of talleſt trees, and ſhuns the habitation of men—the tree but touched at bottom, they quit the neſt, and fly to another tree; thus travelling with eaſe along the tops of the foreſt, until quite out of danger—in Lapland, vaſt numbers remove from one part to another—method of croſſing broad rivers, or extenſive lakes—they have a ſharp piercing note, and another, more like the purring of the cat when pleaſed—the Laplanders eat their fleſh—deſcription of the *common ſort*, and of the *grey Virginian kind*—the *Barbary*;

Siberian white; *Carolina black*; *Braſilian*; *little ground Carolina*, and *New Spain ſquirrel—flying ſquirrel* more common in America than in Europe—its food, and manſion, iv. 31 to 36

Stag, firſt in rank among quadrupedes; its elegant form deſcribed—no obvious difference between the internal ſtructure of the ſtag and the bull, but to a nice obſerver—ruminates not ſo eaſily as the cow or ſheep; reaſon why—manner of knowing its age—differs in ſize and horns from a fallow-deer—increaſe in beauty and ſtature in proportion to goodneſs of paſture, enjoyed in ſecurity—ſeldom drinks in winter, and leſs in ſpring—different colours of ſtags—how watchfully he examines an enemy's approach—delighted with the ſound of the ſhepherd's pipe—of animals natives of this climate, none have ſuch a beautiful eye as the ſtag—beauty and ſize of horns mark ſtrength and vigour—time and manner of ſhedding them—ſevere cold retards the ſhedding—horns increaſe in thickneſs and height from the ſecond year of age to the eighth—ſhedding his horns, hides himſelf in ſolitudes and thickets, and ventures out to paſture only by night—grow differently in ſtags from ſheep or cows—horns found to partake of the nature of the ſoil—a miſtake that horns take colour of the ſap of the tree againſt which they are rubbed—ſtag caſtrated when its horns are off, they never grow again; the ſame operation performed when they are on, they never fall off—one teſticle only tied up, he loſes the horn of the oppoſite ſide—Mr. Buffon thinks the growth of the horns retarded by retrenching the food—horns reſembled to a vegetable ſubſtance, grafted upon the head of the ſtag—time of feeling impreſſions of the rut, or deſire of copulation—effects the rut cauſes—ſtag lives about forty years—voice in the time of rut terrible; and then keeps dogs off intrepidly—a ſtag and tiger encloſed in the ſame area, the ſtag's defence ſo bold, the tiger was obliged to fly, iii. 94 to 106—the ſtag in rut ventures out to ſea from one iſland to another, and ſwims beſt when fatteſt—the hind, or female, uſes all her arts to conceal her young from him, the moſt dangerous of her purſuers---men of every age and nation made the ſtag chace a favourite purſuit---ſtags remaining wild in

England, called red-deer, found on the moors bordering Cornwall and Devonſhire-- manner of hunting ſtag and buck in England---different names given them, according to their ages---terms uſed by hunters purſuing the ſtag---the manner of knowing the track of a ſtag; and that of a hind---he changes his manner of feeding every month; in what manner---ſwims againſt the ſtream---the ancient manner of purſuing him---that of hunting him--and in China---ſtag of Corſica---a kind called by the ancients *tragelaphus*---Germans call it *bran-deer*, or *brown-deer*---a beautiful ſtag, thought a native of Sardinia, though perhaps of Africa, or the Eaſt Indies---its deſcription---*ſtag royal*, in Mexico---*of Canada*, brought into the ſtate of domeſtic tameneſs, as our ſheep, goats, and black cattle, iii. 107 to 124

Staggard, name of the ſtag the fourth year, iii. 113

Stallions, law prohibiting exportation of ſtallions and mares; and another ſimilar, obtained as early as the times of Athelſtan, ii. 369

Staniſlaus, the exiled king of Poland, had a dwarf at his court in Luneville—deſcribed, ii. 255

Stare, bird claſſed with the thruſh; diſtinction from the reſt of its tribe—its reſidence—its eggs—it is eaſily taught to ſpeak—its food, v. 323

Star-fiſh, general deſcription of the tribe—ſubſtance of their bodies almoſt as ſoft as water—no way injured by ſwallowing ſhells almoſt of a ſtony hardneſs—float upon the ſurface of the ſea, and in the dark ſend forth a ſhining light, reſembling that of phoſphorus—called *ſea-nettles*—the paſſage for devouring food, ſerves to eject excrements—taken and put into ſpirits of wine, continue many years entire; but left to influence of air, in four-and-twenty hours melted down into a limpid offenſive water—cut in pieces, every part ſurvives the operation, becoming a perfect animal, endued with its natural rapacity, viii. 174 to 176

Starling, time of migration, v. 32—often lays eggs in holes deſerted by the wood-pecker, 253—ſlender-billed bird of the ſparrow kind, living upon inſects, 314

Stars, fixed, ſuppoſed by philoſophers ſuns reſembling that which enlivens our ſyſtem, i. 6

Stars, falling, meteors, or unctuous vapours raiſed from the earth, kindled and ſupported in the air, until they fall back extinguiſhed, i. 389

Statues of antiquity, firſt copied after human form, now become models of it, ii. 106

Stature, middle in men, from five feet five to five feet eight inches, ii. 108—cauſe of different ſtatures, 237—ordinary of men, Mr. Derham obſerves, probably the ſame now as at the beginning—many corroborating proofs of this, 264

Stellaris, name given by the Latins to the bittern, vi. 5

Steno, his opinion about the formation of the incipient animal, ii. 16

Stigmata, holes through which caterpillars breathe—famous experiment of Malpighi to verify this, viii. 13, 14

Stickleback, the gaſteroſteus of the prickly-finned thoracic ſort; deſcription of this fiſh, vi. 303—this fiſh appears in quantities every ſeventh or eighth year in the river Welland, near Spalding; a man, employed by a farmer to take them, for manuring his grounds, got, for a conſiderable time, four ſhillings a day, ſelling them at a halfpenny a buſhel, 328

Stilicon, his two daughters betrothed, one after the other, to the emperor Honorius, buried with much finery, found eleven hundred years after, in good preſervation, excepting the pearls, vii. 57

Stinkards, name given by our ſailors to one or two animals of the weaſel kind, chiefly found in America, iii. 380—and by the ſavages of Canada to the muſk-rat, iv. 80

Stint, ſmaller and ſhorter billed water bird of the crane kind, vi. 22

Stoat, the ermine, its deſcription, iii. 353

Stomach, names of the four ſtomachs—ſtomach of carnivorous animals ſmall—thoſe of ruminating, ſtrong and muſcular—of inſects, compoſed of muſcular fibres, iii. 2 to 6—the camel has a fifth ſtomach, as a reſervoir of water for occaſional uſe, iv. 307—birds have, properly, but one ſtomach, yet this is different in different kinds, v. 14, 15—that of the cuckoo enormous, reaches from the breaſt-bone to the vent, 266. See *Animals*, ii. 124, 317

Stork, a ruminating bird, iii. 5—true difference between it and the crane—are birds of paſſage—returning into Europe in March—places for their neſts—number of eggs—are a month in hatching; and their young excluded, they are particularly ſolicitous for their ſafety—their food in a great meaſure frogs and ſerpents—the Dutch attentive to the preſervation of the ſtork in their republic, the bird protected by the laws, and the prejudices of the people—countries where found—ancient Egyptians regard for this bird carried to adoration—the ancient ibis ſuppoſed the ſame which at preſent bears the ſame name; a bird of the ſtork kind, about the ſize of a curlew, v. 382 to 385

Storms, foretold by the barometer, i. 352—above their region, all is calm and ſerene, 353—riſe ſo the tops of the higheſt mountains—confirmed by thoſe who have been on the Andes, and by the deep ſnows that crown them, 353, 354—with powerful effects, do not ſhew great ſpeed, 356—one moſt dreadful in Hertfordſhire, in 1697—deſcription of it, 374—do not terrify goats, iii. 53

Stones, ſhower of ſtones and other matters raiſed by ſtorms in one country, carried to another, fall ſuddenly as ſhowers of rain, i. 389

Stone of ſhammoy, generally about the ſize of a walnut, and blackiſh—formerly in requeſt for the ſame virtues with oriental bezoar, iii. 69

Stone-chatter, ſlender-billed bird of the ſparrow-kind, v. 314—migrates, 318

Stove, its warmth expeditious for hatching, and efficacious in bringing the animal in the egg to perfection, ii. 27

Strabiſm, an inequality of ſight, and particular caſt of the eye; whence it proceeds, ii. 157

Stream of rivers, more rapid in proportion as its channel is diminiſhed, and why, i. 205—the ſurface ſwifter than the bottom, and why—iſlands, turnings, and other obſtacles retard the courſe but inconſiderably, and why, 206

Strength, a juſt way of eſtimating human ſtrength, by perſeverance and agility of motions—not hereditary—

prodigies of it in Milo, and alſo in Athanatus—eſtimation of ſtrength in Maximin, the emperor, deſcribed—inſtance of it in animals by the bulk of their muſcles very fallacious; thin and raw-boned men being generally ſtronger and more powerful than thoſe ſeemingly more muſcular—women much inferior in ſtrength to men—of man leſs valuable ſince the invention of gunpowder, of new machines, and the application of the power of animals to the purpoſes of life—the comparative ſtrength of a horſe, meaſured, not by what he can carry, but by what he can draw, ii. 114 to 120—of the inhabitants round the poles is amazing, 218

Stromateus, a ſoft-finned apodal fiſh, deſcribed, vi. 305

Struthophagi, ſome nations ſo called from their fondneſs for the fleſh of the oſtrich, v. 59—their method of taking it, 61

Stuffs made of hair of animals about Angora, iii. 58—half compoſed of ſilk forbid to be worn at home, as a luxurious refinement, viii. 49

Stunts, name given to whales at the age of two years, vi. 196

Sturgeon, a cartilaginous fiſh, of a conſiderable ſize, yet flies terrified from the ſmalleſt fiſhes—its deſcription—three kinds of it—countries of Europe this fiſh viſits at different ſeaſons—annually aſcends the largeſt rivers to ſpawn, and propagates in vaſt numbers—enjoying the viciſſitude of freſh and ſalt water, then grows to an enormous ſize, almoſt to rival the whale—the largeſt caught in Great Britain taken in the Eſke, where frequently found weighing four hundred and fifty pounds—places where caught in numbers—never by a bait, always in nets—their food—whence the German proverb, *he is as moderate as a ſturgeon*—live in ſociety among themſelves; and Geſner has ſeen them ſhoal together at the notes of a trumpet—uſual time of coming up rivers to ſpawn—at Pillau the ſhores formed into diſtricts, and allotted to companies of fiſhermen, and rented ſome for three hundred pounds a year—nets in which caught—in the water it is one of the ſtrongeſt fiſhes, and often breaks the nets that encloſe ir, but its head once raiſed above water, its activity ceaſes—has broke fiſhermen's legs with a blow of its tail—two methods of preparing it

—that from America not ſo good as from the north of Europe—caviar made with the roe of all kinds of ſturgeon—manner of making it, vi. 271 to 278

Sturmey, the captain who deſcended into Penpark-hole, where remaining five hours, coſt him his life, i. 66

Sucking-fiſh, the remora, ſticks to the ſhark—alſo called the ſhark's pilot, and why, vi. 241

Sucking-fiſh, the echeneis, a ſoft finned thoracic fiſh, its deſcription, vi. 306

Suction, from whence that amazing power in the lamprey ariſes, vi. 266

Sugar, the white ſort in the tropical climates ſometimes full of maggots, i. 314

Sulphur, with iron filings kneaded together into a paſte, with water when heating, produces a flame, i. 76

Sun, mock-ſuns and other meteors ſeen in the Alps, i. 145—in the polar regions, 377—reflected upon oppoſite clouds, appear like three or four real ſuns in the firmament—real ſun always readily known by ſuperior brightneſs—the rainbow alſo different in thoſe countries, 387—its warmth efficacious in bringing the animal in the egg to perfection, ii. 27—not eaſy to conceive how it whitens wax and linen, and darkens the human complexion, ii. 235

Sun-fiſh, an anomalous cartilaginous fiſh, like a bulky head, its deſcription, vi. 281

Surf of the ſea, name the mariners give the riſing waves breaking againſt the ſhore, i. 273

Surinam rat, the phalanger, a ſmall monkey, deſcribed, iv. 248

Surinam toad, the pipal, a hideous toad, its deſcription, vii. 108

Surmalot, with Mr. Buffon, the great rat, a hateful rapacious creature, deſcribed, iv. 65

Surmulet, the mullus, a ſpinous fiſh, its deſcription, vi. 302

Swallows, time of their migrations—departure of ſome, and retreat of others into old walls, from the inclemencies of winter, wrap the migrations of birds in great obſcurity, v. 37—experiment of Mr. Buffon to this purpoſe, 38—with us birds of paſſage; breed in

Upper Egypt and the land of Java, and never diſappear, 318—*houſe-ſwallow*—characteriſtics of the ſwallow-tribe—their food—have the greateſt ſwiftneſs and agility—at the end of September they depart; ſome feeble wretched families, compelled to ſtay, periſh the firſt cold weather—thoſe migrating firſt ſeen in Africa in the beginning of October, having performed their journey in ſeven days—ſometimes ſeen, interrupted by contrary winds, wavering in their courſe at ſea, and lighting upon the ſhips in their paſſage—a doubt whether all ſwallows thus migrate, or ſome other of this ſpecies externally alike, and internally different, be differently affected by the approach of winter—obſervations made to this purpoſe by Reaumur, Friſch, and Klein—indicate approaching change of weather—their neſts, and thoſe they build on the coaſts of China and Coromandel—Chineſe pluck them from rocks, and ſend great numbers into the Eaſt Indies for ſale—gluttons eſteem them great delicacies diſſolved in chicken or mutton broth—the number of their eggs, v. 346 to 353

Swallows of Ternate, or *God's birds*, the bird of paradiſe, deſcribed, v. 257 to 260

Swammerdam. See *Inſects*, vii. 17

Swan, a ſtately web-footed water fowl; though an indifferent figure upon land, is beautiful in the water—doubt whether the tame kind be in a ſtate of nature—none found in Europe—the wild ſwan, though ſtrongly reſembling it in colour and form, yet another bird—differences between wild and tame ſwans—conſidered a high delicacy among the ancients—the tame moſt ſilent, the wild has a loud and diſagreeable note—from thence called the hooper—accounts ſufficient to ſuſpend an opinion of its muſical abilities—their food, neſt, and number of eggs—a blow with the pinion breaks a man's leg or arm—two months hatching, and a year growing to proper ſize—longeſt in the ſhell of any bird—ſaid to live three hundred years—by an act of Edward IV. the ſon of the king was allowed to keep a ſwan, and no others, unleſs poſſeſſed of five marks a year—puniſhment for taking their eggs, was impriſonment for a year and a day, and fine at the king's will—places which abound with them, vi. 111 to 118

Swarms of a bee-hive, ſeveral ſwarms in the year, the firſt always the beſt and moſt numerous, viii. 86

Sweden, aſſes a ſort of rarity in Sweden, ii. 385

Sweetmeats, in tropical climates, expoſed by day in the ſun, to prevent their putrifying by the night air, i. 314

Swift, a bird of the ſwallow kind; peculiar poſition of the toes, v. 346, 347

Swiftneſs of ſavages, many ſurpriſing ſtories about it, ii. 115—of the zebra, a proverb among the Spaniards and Portugueſe, 396

Switzerland, the peaſants kill a cow for their own table, ſalt and hang it up, to preſerve as a delicacy the year round, iii. 9

Sword-fiſh, the xiphias, its deſcription, vi. 299—its terrible encounters with the whale deſcribed, 199

Syaguſh, called by Mr. Buffon the caracal of the lynx-kind, a native of the Eaſt Indies, reſembles the ounce in ſize, iii. 258—met with only in warm tropical climates—uſed, in the ſame manner as the ounce, for hunting—called alſo the lion's provider; and ſaid when it calls him to purſue prey, its voice reſembles that of a man calling another—one ſent over from the Eaſt Indies, could not endure the change of climate—has killed a large dog in ſingle combat; yet remarkable for cowardice—how it makes the gazelle and antelope eaſy preys to the hunters, iii. 265 to 267

Syaguſhes, carnivorous animals, like the jackall and wolf; hunt in packs, and encourage each other by their cries, ii. 322

Symmetry, and proportion of the human body, ii. 79

Sympathetic, affection of yawning, ii. 91

Synovia, a lubricating liquor in the joints, ſo called by anatomiſts, ii. 109

Syria, moſt of its cities deſtroyed in 1182 by an earthquake, i. 111

Syſtem, in what manner the harmony of our planetary ſyſtem is preſerved, i. 4—very uſeful in natural hiſtory—books containing them, uſeful to be conſulted, but unneceſſary to be read—that of Linnæus deſerves the preference—faults of ſyſtematic writers in natural hiſtory, ii. 290 to 293—what has given birth to the variety of ſyſtems in natural hiſtory, 300. See *Gouan,* vi. 298

T.

Tabbies, ſtreaked cats, to which the civet's colour is compared, iii. 390

Tajacu, the peccary, an animal of the hog kind, peculiar for a lump upon its back, with glands diſcharging a muſky ſubſtance, iii. 183

Tails of ſheep a foot broad, and weighing from twenty to thirty pounds, ſometimes ſupported by a board upon wheels, iii. 47

Tail, uſe made of it by the whale—is about twenty-four feet broad, vi. 190, 191

Talapoin, eighth diviſion of monkies of the ancient continent—its deſcription, iv. 234

Talons, in what manner produced in animals, ii. 101

Tamaim, a monkey of the ſecond ſort of the ſagoin kind—deſcription, iv. 237

Tamandua, an ant-bear, larger and ſmaller, live upon ants—their deſcription, iv. 337

Tamis-bird, one of the names of the Guinea hen, deſcribed, v. 192, 193

Tanais, the Don, a principal river of Europe, parting it from Aſia, i. 209—affords great numbers of ſturgeon, vi. 273

Tanrec, of the hedge-hog kind, different enough to conſtitute another ſpecies—covered with prickles, though mixed with hair—does not defend itſelf by rolling up in a ball—only found in the Eaſt Indies—ſleeps ſeveral months, and loves to be near water—in the torpid ſtate, its hair falls off—Indians conſider its fleſh a delicacy, iv. 105 to 107

Tapeti. See *Rabbit* (Braſilian), iv. 54

Tapir, the largeſt animal of America, no way comparable in ſize to the elephant of Africa, ii. 332—conſidered as the hippopotamos of the new continent—its deſcription—reſides in the water—its food—its fleſh thought a delicacy, iv. 330, 331

Tar, uſed by the Laplanders for all diſorders of the rein-deer, iii. 169

Tarantula, the bite of this animal, and its cure by muſic, all a deception—inſtance of it, ii. 171—native of Apulia in Italy—deſcription—its bite not attended with dangerous ſymptoms—fables of its virulence, vii. 264, 265

Tarcel, name falconers give the male bird of prey; and why, v. 84

Tariguagua, ruggedneſs of road from it up to the Andes, is not eaſily deſcribed, i. 149

Tarnaſſar, great bird in the Eaſt Indies, no other than the condor, v. 105

Tarrier, firſt diviſion of dogs of the generous kind, uſed for hunting, iii. 286

Tarſier, a monkey, laſt of the claſs of the oppoſſum kinds—its deſcription—why ſo called, iv. 248

Tartars, their religion conſiſts in part by managing their whiſkers—they waged a bloody war with the Perſians as infidels, not giving their whiſkers the orthodox cut, ii. 96—the Oſtiac, a race travelled down from the North, and originally ſprung from minute ſavages, 219—Samoeid, firſt diſtinct race of men round the pole, deſcribed, 213, 214

Tartary, in general, comprehends great part of Aſia—deſcription of natives and manners, ii. 219, 220

Taſte, in all ſubſtances on mountain tops, and valley bottoms, i. 335—to determine ſomewhat upon the nature of taſtes, bodies to be taſted muſt be moiſtened, or diſſolved by ſaliva, to produce a ſenſation; the tongue and body to be taſted, being dry, no taſte enſues—taſtes rendered agreeable by habit — reliſh of taſtes ſtronger in children than in perſons advanced in life—higheſt epicure has the moſt depraved taſte, ii. 183, 184

Tatou, or armadilla, a quadrupede of the new continent, covered with ſhells, iv. 124. See *Armadilla.*

Tatu-apara, firſt of the kinds of armadilla—the ſecond, the tatou of Ray, or the encoubert of Mr. Buffon—the third, the tatuette—their diverſities deſcribed, iv. 132, 133

Teal, ſmalleſt bird of the duck-kind, diſtinguiſhed, vi. 127

Teats, great variety of them in animals—their form, and how placed, ii. 103

Teeth in cows, eight cutting teeth in the lower jaw—manner of renewing them, iii. 11

Tegg, what the hunters call the doe the ſecond year, iii. 128

Tejuguacu, tockay, and cordyle, all of the lizard kind, gradually leſs, fill up the chaſm between the crocodile and the African iguana, vii. 149

Tempeſts, loudeſt formed by united contributions of minerals, vegetables, and animals, encreaſing the ſtreams of air fleeting round the globe, i. 338—frequent under the tropics, and a ſpace beyond them, 356—tempeſts of ſandy deſerts raiſed in one country, and depoſited on another, 357—in Arabia and Africa deſcribed, 363

Teneriffe (the peak of) computed a mile and a half perpendicular from the ſurface of the ſea, i. 153

Teneriffe (iſland of), the art of embalming preſerved among the ancient inhabitants, when conquered by the Spaniards, ii. 272

Tendrac, an animal leſs than a mole, different from the hedge-hog, and a different ſpecies—deſcription—grunt like hogs, and love to be near water—they multiply in numbers—ſleep ſeveral months—its fleſh a great delicacy with the Indians, iv. 105 to 107

Ternate, a Molucca iſland, its ſwallow taken for the bird of Paradiſe, v. 260

Teſtaceous ſubſtances in variety on the tops of mountains, and in the heart of marble, i. 17

Thales the philoſopher, held all things made of water, i. 166

Thames water, and that of the Indus, moſt light and wholeſome, i. 170

Theories of the earth, thoſe of the moſt celebrated authors, i. 22

Theory of evaporation, for the formation of clouds, i. 369—other theories upon that ſubject, 367—theory of ſympathy, of father Mallebranche, beautiful upon monſtrous productions, ii. 246

Theraſia, an iſland appeared unexpectedly to mariners on other purſuits, i. 125

Thermometer, meaſures heat and cold by a fixed ſtandard—deſcription, i. 177. See *Blood*, iv. 45

Theſſaly, the horſes there reputed excellent for war, ii. 365

Theutys, a prickly-finned abdominal fiſh—deſcription of it, vi. 304

Thibet, the muſk from thence reckoned the beſt—ſells at fourteen ſhillings the ounce, iii. 93—the peacock there the moſt beautiful of the feathered creation, v. 176

Thoracic fiſh, that which has the ventral fins directly under the pectoral fins, vi. 297

Thouloufe, bodies buried in the monaſtery of Cordeliers in that city, do not putrify, ii. 276

Throat of the great Greenland whale is ſo narrow, that any animal larger than a herring could not enter, vi. 197—but that of the cachalot can with great eaſe ſwallow an ox, 213—that of the ſhark moſt amazing, 234

Thruſh, a ſlender-billed bird of the ſparrow kind, v. 314—its diſtinction from all of the kind—its ſong very fine—the largeſt of the tribe with a muſical voice, 320—its food, 321

Thumb-footed ſhell-fiſh, teſtaceous, deſcribed, vii. 64

Thunder, Ulloa heard it rolling beneath him, when upon the Andes, i. 152—its cloud always moves againſt the wind, 353—a ſound produced by the oppoſition of two clouds, and continued by reverberated echo—thunder clears the air, and kills inſects noxious to vegetation, 374—reſembled by the roaring of the lion heard in the night, and re-echoed by the mountains, iii. 224

Thuroid cartilage forms a lump upon the wind-pipe in men, not ſeen in women, ii. 102

Tides, with Pliny, were influenced partly by the ſun, and in a greater degree by the moon—Kepler firſt conjectured attraction the principal cauſe of them—the preciſe manner diſcovered by Newton—high tides happen at the ſame, on oppoſite ſides of the globe, where waters are fartheſt from the moon—ſolar and lunar tides—greateſt in ſyzigies, leaſt in quadratures—flows ſtrongeſt in narroweſt places—Mediterranean, Baltic, and Black Sea, no ſenſible tides, the gulf of Venice excepted; and why—higher in the torrid zone, than in the reſt of the ocean—greateſt at the river Indus, riſing thirty feet—remarkably high on the coaſts of Malay, in the ſtreights of Sunda, the Red Sea, the gulf of St. Lawrence, along the coaſt of China and Japan, at Panama, and in the gulf of Bengal—thoſe at Tonquin moſt remarkable in the world; one tide, and one ebb, in twenty-four hours; twice in each month no tide at all—in the ſtreights of Magellan it riſes twenty feet, flows ſix hours, and the ebb laſts but two hours, i. 251 to 259

Tiger, leaps twenty feet at a ſpring, ii. 322—often bigger than the lion—nothing tames it—perfectly reſembles the cat, iii. 234, 238—three ſorts in Sundah Rajah's dominions, 240—the royal tiger—carries a buffalo over its ſhoulder to its den, 241—attacks the lion, 225—defeated by a ſtag, 106—taught to defend herds, 199—ſaid to follow the rhinoceros for its excrements, 236—other tales about it, 243—under Auguſtus, a tiger an extraordinary ſight—the ſpecies ſcarce—opinion of Varo, that it was never taken alive, 242—the ancients commended it for beauty among quadrupedes, equal to that of that of the peacock among birds, 233—ſuppoſed to bring forth four or five young at a time, 242—expreſſes his reſentment as the lion—the ſkin eſteemed in the Eaſt, particularly in China, 243—battle of one tiger and three elephants at Siam deſcribed, 239—another between a tiger and a crocodile, 247—the red tiger, Mr. Buffon's cougar, 244—common in Guiana, Brazil, Paraguai, and other parts of South America, 248—the fleſh ſuperior to mutton, 249—and eſteemed by the negroes as a dainty, 298

Tiger-cat, or cat-a-mountain, the ocelot of Mr. Buffon—a beautiful animal of its kind, iii. 255

Tigris, a great river in Aſia, loſt under mount Taurus, i. 224

Tingitanians and Egyptians famous for the fineſt horſes in ſize and beauty, ii. 356

Tipula (water) of the ſecond order of inſects--deſcription of it, vii. 358

Tipula, long legged gnat, deſcription of this inſect—only difference between it and the gnat, viii. 151

Titmouſe, a ſlender-billed bird of the ſparrow-kind, v. 314

Toad, ſome bigger than ducks, ii. 6—their fleſh eaten as a delicacy on the coaſt of Guinea, iii. 298—differences between the frog and it, as to figure and conformation, vii. 73, 74—their nature, appetites, and food—coupling—difficulty in bringing forth—curious particulars relating to this animal—one ſwallowing a bee alive, the ſtomach ſtung, and the inſect vomited up again—toads not venomous—accounts of toads taken inwardly—a harmleſs, defenceleſs creature, and unvenomous—torpid in winter—retreat then—difficult to be killed—lives for centuries in a rock, or within an oak, without acceſs, nouriſhment, or air, and yet found alive and perfect—accounts of this—toads ſuck cancerous breaſts, and perform a cure—progreſs of this operation—the rubeth, the land-toad, alone has the property of ſucking—doubtful whether they die by internal or external application of the cancerous matter—varieties of the animal—deſcription of the Surinam toad, called pipal, vii. 92 to 108

Tococo, ſort of cry, given as a name in Canada to the flamingo; and why, vi. 16

Toes, uſually four in all animals of the poultry kind; in a ſpecies of cock amount to five, v. 160

Tongres, a city in the country of Liege, formerly encompaſſed by the ſea, and at preſent thirty-five leagues diſtant from it, i. 276

Tongue, of the rein-deer, a great delicacy, iii. 167—the flamingo's much celebrated, and larger than that of any other bird, vi. 15—of the Great Greenland whale, fills ſeveral hogſheads with blubber, vi. 192

Teeth, coloured, the paſſion for them in China and Japan—in ſome parts of India black teeth deſired with ardour, ii. 77—teeth of animals various—how formed in man, 101—of the elephant, ſhed like horns of deer, or obtained after death, not yet known—natives of Africa find them in their foreſts, iv. 281—of the narwhal ſurpaſſes ivory, vi. 209—aſcribed to a different animal—curioſity, and the deſire of ſcarce things, made them very valuable a century ago, 211—the white ſhark is ſaid to have one hundred and forty-four teeth, 235

Tornado, a formidable tempeſt, ſo called by the Spaniards—its deſcription and dreadful effects, i. 361

Torpedo, its deſcription—by an unaccountable power, the inſtant touched, even with a ſtick, when immediately taken out of the ſea, it numbs the hand and arm, or whole body—the ſhock reſembles an electrical ſtroke; ſudden, tingling, and painful—account by Kempſer of numbneſs produced by it—he believes holding in the breath prevents the violence; implicit belief of efficacy would be painfully undeceived—this power not exerted upon every occaſion—trials by Reaumur to this purpoſe—opinions concerning the cauſe of this ſtrange effect—the fiſh dead, the power deſtroyed, then handled or eaten with ſecurity—the power not extended to the degree ſome believe, reaching the fiſhermen at the end of the line, or numbing fiſhes in the ſame pond—ridiculous exceſs of this numbing quality in the hiſtory of Abyſſinia, by Godignus—Lorenzini, from experiments, is convinced the power reſides in two thin muſcles of the back—ſeveral fiſhes have acquired the name of torpedo, poſſeſſed of the ſame quality—Moore's and Condamine's accounts of them, vi. 257 to 263

Tortoiſe, ranked among cruſtaceous fiſhes, though ſuperior to them all—amphibious, according to Seba—diſtinguiſhed in two claſſes, the *land tortoiſe*, and the *ſea turtle*—differ more in habits than conformation—deſcription—principal diſtinctions—varieties are, *trunk-turtle*, *loggerhead*, *haws-bill*, and *green-turtle*—the ſhell never changes, and growing with the body, is formed in pieces—all generally found in warm countries without retiring—a defence againſt dangerous attacks—the blood warm and red—how circulated—turtle larger than tortoiſe—weighs from fifty to five hundred pounds—ancients ſpeak of ſome of amazing ſizes—live to eighty and a hundred and twenty years—can live without limbs, head, or brain, proved by experiments of Redi—moves with great weight upon it—hears diſtinctly, by means of an auditory conduit opening into the mouth—ſighs when ill ſituated, and ſheds tears when diſtreſſed—torpid during winter, ſleeping in ſome cave, and breathing imperceptibly—account of a land tortoiſe caught in a canal at Amſterdam—and of a turtle in the Loire in 1729, vi. 374 to 399—the food chiefly vegetables, though believed to eat inſects, ſnails, and bugs, vi. 386, vii. 25. See *Turtle*.

Toucan, a bird of the pie kind, has a bill as large as its body—of five varieties; the red-beaked deſcribed—its food—pepper voided unconcocted by the toucan, preferred to that freſh gathered—Pozzo bred one tame—its habits and food—has birds, men, monkies, and ſerpents to guard againſt—ſcoops out its neſt into the hollow of ſome tree, leaves ſcarce room to go in and out, and with its great beak guards that entrance—found only in warm parts of South America, where it is valued for its tender and nouriſhing fleſh, and the beauty of its plumage, particularly the breaſt, the ſkin of which the Indians dry and glue to their cheeks for beauty, v. 243 to 247

Touch, thoſe parts of the body moſt exerciſed in touching, acquire the greateſt degree of accuracy—the fingers, by long habit, not from a greater quantity of nerves, become maſters in the art, ii. 185

Tournefort. See *Spouts*, i. 390

Trachinus, the weever, a prickly-finned jugular fiſh, deſcribed, vi. 300

Trachipterus, the ſabre, a prickly-finned thoracic fiſh—its deſcription, vi. 303

Track of a ſtag, manner of knowing it, and that of a hind, iii. 115

Trade, of hair of animals, driven by the inhabitants of Angora, iii. 58

Tragelaphus, name of a ſtag with the ancients—found in the foreſts of Germany, and called by the natives bran deer, or the brown deer, iii. 122

Traps for horſes, uſed by the Arabians for the wild ſort, ii. 348—for wild aſſes, alſo uſed in the Archipelago, 377—for mice, deſcribed in variety by Geſner, iv. 74

Treacle, food for bees during winter, when robbed of their honey, viii. 75

Trees, (foſſil) in the body of ſolid rocks, and deep under the earth upon which they once grew—conjectures upon this ſubject, i. 49, 50—found in quantities at the mouth of the river Neſs in Flanders, at the depth of fifty feet, 281—laying twenty-feet deep under ground for many ages, becomes hard and tough, proofs of alternate overflowings and deſertions of the ſea, 284—uſually of the largeſt kinds in wide uncultivated wilderneſſes, in the ſtate of rude nature, ii. 10—the banana and plantane, ſo immenſe, as to be inimically inhabited by monkies, ſnakes, and birds of moſt delightful plumage, v. 255—age known by the number of their circles, vi. 172

Trembley. See *Polypus*, viii. 172

Tricburus, a prickly-ſinned apodal fiſh of a ſword-like form, deſcribed, vi. 299

Trigla, the gurnard, of the ſpinous kind, deſcription of this fiſh, vi. 303

Trocbus, the ſnails of that kind have no mouth—their trunk—are among ſnails, what the tiger, eagle, or ſhark are among beaſts, birds, or fiſhes, vii. 33

Troglodyte of Bontius, is the ouran-outang, or wild man of the woods, iv. 189

Troglodytes, the mountain of that name in Arabia has a paſſage through it made by a diſruption, as if artificial, i. 157

Tropical ſeas, are thoſe in which ſpouts are ſeen very commonly, i. 390—under them, and for a good ſpace beyond, tempeſts are frequent, and their effects anticipated, 356—ſuppoſed by Linnæus the native ſpot of man, and the northern climates only places of ſojourning for them—an argument ſufficing to prove the contrary, ii. 240—the climates ſo hot, dogs in proceſs of time loſe the delicacy of their ſcent entirely, and why, iii. 262

Trumpets, encreaſe ſounds, in the ſame manner as the teleſcope does bodies—perſons hard of hearing find the ſame advantage in the trumpet made for this purpoſe, that the ſhort-ſighted perſons do from glaſſes; were they farther enlarged, they could be uſed to advantage only in a place of ſolitude and ſtillneſs, as the multitude of ſounds would produce tumult and confuſion, ii. 174

Trunks of animals, that of the elephant deſcribed, iv. 259—that of the gnat may juſtly be deemed one of nature's maſter-pieces, viii. 154

Trygon, the fireflare, the enchantreſs Circe armed her ſon with a ſpear headed with the ſpine of this fiſh, vi. 256

Tubes of glaſs, drawn as fine as a hair, ſtill preſerve their hollow within, i. 192

Tubular veſſels, diſcovered by Fallopius, and called his tubes, ii. 17

Tufted-duck, a variety of the kind, native of Europe, vi. 126

Tumble-dung, a ſtrong beetle, remarkable for make and manners, viii. 137

Tumbler, in the diviſion of Dr. Caius, a dog of the firſt claſs, or generous kind, iii. 286—ſuppoſed the lurcher, and deſcribed, 288

Turbinated ſhells, are univalves, and the firſt kind of Ariſtotle's diviſion, vii. 12

Turbits, variety of the tame pigeons, obtained by croſs breed, v. 293

Turbots, (and rays) extremely delicate in their choice of baits; a piece of herring or haddock twelve hours out of the ſea, and uſed as a bait, will not be touched, vi. 253—growth of turbots, 334

Turkey, bird of the poultry kind—its native country diſputed; arguments for the old and new continent—firſt ſeen in France in the reign of Francis I. and in England in that of Henry VIII.—its tenderneſs with us, when young, argues not for our climate—in the wild ſtate, hardy and numerous in the ſnowy foreſts of Canada—alſo larger and more beautiful than in the domeſtic ſtate—the ſavages weave the feathers into cloaks, and faſhion them into fans and umbrellas—hunting the turkey a principal diverſion with them, its fleſh chiefly ſupporting their families—manner of hunting, v. 177 to 179

Turkeys, a ſtupid, vain tribe, quarrelling among themſelves—the cock's antipathy to red—briſtles, and flies to attack it—manner of increaſing their animoſity for diverſion—weak and cowardly againſt the weakeſt animals that dare face them—the cock purſues what flies from him, as lap-dogs and children, then returns to his train, diſplays his plumage, and ſtruts about—the female milder, gentler, and particularly fond of ants and caterpillars eggs—lays eighteen or twenty eggs, larger than a hen—the young very tender at firſt, muſt be carefully attended to—account of Abbé Pluche, of a turkey-hen and her brood at the ſight of a bird of prey—turkies of Norfolk the largeſt of this kingdom, ſome weigh thirty pounds; in Eaſt India, in domeſtic ſtate, grow to weigh ſixty pounds, v. 180 to 183

Turky, in Aſia, has in different parts horſes of almoſt all races, ii. 361—lions found to diminiſh in number in this country, iii. 215

Turn-ſpit, a dog of the mongrel kind, and the lower claſs of Dr. Caius's diviſion, iii. 286

Turnſtone, a ſmall bird of the crane kind, vi. 22—likes colder climates in ſummer, or wildeſt and moiſteſt parts in this country—is a bird of paſſage, 27

Turtle-dove, one of the ruminating birds, or with a power of diſgorging food to feed its young, iii. 5

Turtle, prepares for laying, and depoſits her eggs in the ſand, where in twenty-ſix days they are hatched by the ſun—lay from one hundred and fifty to two hundred in a ſeaſon—the young from the egg, with their ſhell, ſeek their food untaught, and, at the ſize of quails, run by inſtinct to the ſea, ignorant of all danger, vi. 385—propagated on ſhore only—comes from ſea on purpoſe in coupling ſeaſon—female is paſſive and reluctant; the male is ſlow, but graſps ſo faſt, nothing looſe the hold, 394 to 400

Turtle, article of commerce, the ſhell put to many uſes; of the *hawk's bill* the fineſt; conſiſts of eight flat, and five hollow plates—how manufactured—the fleſh, particularly of the *green turtle*, prized as a delicacy, and is wholeſome—the *great Mediterranean* the largeſt of all, unfit and unſafe to eat; its ſhell is unprofitable for uſe—ſeveral ways of catching turtles, vi. 387 to 400

Tuſks, thoſe of a boar, ſometimes a foot long, iii. 172—of the babyroueſſa, a fine ivory, ſmoother and whiter than the elephant's, but not ſo hard—of enormous ſize, 194—of caſtrated animals, ſcarce appear without the lips—broken, abate his fierceneſs and venery, producing nearly the ſame effect as caſtration, 197—of the mammouth, weigh four hundred pounds; thoſe of the elephant from Africa, two hundred and fifty—ſome remarkable, lately found near the Ohio and Miume, in America, iv. 282—Dr. Hunter thinks them of a larger animal than the elephant, 283—of the narwhal, or ſea-unicorn, a cetaceous fiſh with teeth, from nine to fourteen feet long, vi. 207 to 210

Twins, never, while infants, ſo large or ſtrong as children that come ſingly into the world, and why, ii. 48

Typhons, ſpouts ſo called, ſeen at land, differ in ſeveral reſpects from thoſe at ſea, i. 394

Tyſon (Dr.) See *Ouran-outang*, iv. 190

V.

Valerian, a plant of which cats are exceſſively fond, iii. 206

Valle, (Pietro) his deſcription of Perſian horſes, ii. 361

Vampyre, a foreign bat. See *Bat*, iv. 144

Vanſire, a ſort of ferret of Madagaſcar, according to Mr. Buffon, iii. 362

Vapour, of metals in mines not ſo noxious, as thoſe of ſubſtances with which ores are uſually united, ſuch as arſenic, cinabar, &c.—fragrance of their ſmell—warnings about them, i. 79, 80—diſengaged from water, and attenuated, aſcends into the atmoſphere, where condenſed, and acquiring weight as it rolls, falls down in a ſhape ſuitable to the temperature of its elevation, 370 to 373—moſt fœtid, breathed from the jaws of the wolf, iii. 323

Varenius, his opinion upon the formation of rivers, i. 199

Vari, a kind of maki, laſt of the monkey kind, iv. 240—its deſcription, 241

Vault, go to vault, phraſe uſed by hunters when the hare enters holes like the rabbit, iv. 10

Vegetables, vegetable earth—the bed of it, in an inhabited country, muſt be always diminiſhing, and why, i. 56—plant, with a round bulbous head, which, when dried, becomes of amazing elaſticity, grows near the extremity of that region, on mountains where continual froſt reigns, 151—like fluids and mineral ſubſtances, produce air in a copious manner, 318—totally unprotected, and expoſed to every aſſailant, ii. 2—thoſe in a dry and ſunny ſoil, are ſtrong and vigorous, not luxuriant; and thoſe the joint product of heat and moiſture, are luxuriant and tender—different kinds appropriated to different appetites of animals, and why—birds diſtribute the ſeeds of vegetables where they fly, 5—vegetables cover the bottom of many parts of the ſea, 6—but few noxious—that life as much promoted by human induſtry, as animal life is diminiſhed, 13—the aſs gives preference over others to the plantane, 381—

the ſole food of ruminating animals, iii. 1—animals feeding on vegetables moſt inoffenſive and timorous, iv. 3—ſome poſſeſſed of motion—what conſtitutes the difference between animal and vegetable life, difficult, if not impoſſible, to anſwer, viii. 161—not poſſeſſed of one power which animals have, the actual ability, or aukward attempt at ſelf-preſervation, 163—thoſe called marine grow to a monſtrous ſize, 179

Vegetation, anticipated in its progreſs by bees, viii. 74

Velino, a river in Italy, has a cataract of a hundred and fifty feet perpendicular in height, i. 222

Velocity, not alone the actuating force of winds, but alſo the degree of denſity, i. 355

Velvet, like downy ſubſtance upon the ſkin covering the ſkull, when the horn of a deer is fallen off, iii. 96

Velvet-duck, a variety of the common duck, a native of the European dominions, vi. 126

Venery, partridges immoderately addicted to it, to an unnatural degree, v. 209

Venom, given to the weapon of the fireflare by Pliny, Ælian, and Oppian, in a degree to affect the inanimate creation—many reaſons to doubt of it, vi. 255, 256

Venus. See *Noſe*, ii. 76 See *Face*, ii. 265

Verges, or orifices of the ſnails, are two, one active, the other paſſive, vii. 31

Vermin, hoſpitals erected by the Bramins in India for the maintenance of all kinds of vermin, ii. 225—leſs found with aſſes, than with other animals covered with hair, 386

Vertigo in goats produced by immoderate cold, iii. 54

Veſuvius, its eruptions—the moſt remarkable deſcribed by Valetta—account of another by biſhop Berkeley, i. 91 to 98

Vibrations of a bell ceaſe to be heard when under the receiver of an air-pump, i. 334—the tone of a ſonorous body made to depend upon the number of vibrations, not the force, is a miſtake of an effect for a cauſe, ii. 164

Vineta, a port of Pomerania, overflowed and deſtroyed by the Baltic, i. 278

Violet-crab, of the Caribbee iſlands, moſt noted for ſhape, delicacy of fleſh, and ſingularity of manners, vi. 362

Viper, moſt vivacious of reptiles—experiment on a viper in the receiver of the air-pump by Mr. Boyle, i. 316—kept in boxes for ſix or eight months without any food—its progreſſive motion, vii. 179, 180—the only animal in Great Britain whoſe bite is feared—do not devour their young—their food—by the application of ſallad-oil, the bite of the viper effectually cured—who firſt diſcovered this remedy—effects of the viper's bite, vii. 203 to 207

Viſion, its errors—objects repreſented upſide-down, and double—the point without ſenſation—and want of meaſure for diſtance, ii. 147 to 151

Viviparous and oviparous animals, the two claſſes for generation and production—all other modes held imaginary and erroneous, ii. 22—the blenny, a ſpinous fiſh, brings forth two or three hundred young at a time, alive, and playing around, vi. 173

Ukraine, the cattle there become very fat, and conſidered the largeſt of all Europe, iii. 19

Ulloa, his deſcription of part of South America, of Cotopaxi, of Quito, of the Andes, and a volcano, i. 99 to 103

Umbilical veſſels, thoſe of the placenta to the fœtus, ii. 41

Unan, one of the two kinds of the floth, an animal about the ſize of a badger, iv. 342

Under-hung, expreſſion among painters, meaning a prominent under jaw, ii. 91

Underſtanding, comparative progreſs of it—greater in in infants, than in children three or four years old, ii. 61

Undulations, in elaſtic bodies, ſuppoſed by the ear one continued ſound, though in reality many, ii. 163

Unicorn of the ſea, a whale with teeth in the upper jaw, its deſcription, vi. 207. See *Narwhal.*

Univalve ſhells, firſt diviſion by Ariſtotle, as to figure, vii. 12

Voice of birds much louder for their bulk than animals of other kinds—ſet to muſic by father Kircher, v. 143

Volcano, conſidered as a cannon of immenſe ſize, the mouth near two miles circumference, i. 87—opinions of philoſophers and ignorant men about it, 88—the real cauſes—three very remarkable in Europe, and which, 89—Albouras, moſt famous in Aſia—one in the iſland of Ternate, 98—in the Molucca iſlands, in Japan, in Java and Sumatra, in the Cape de Verd iſlands, the peak in Teneriffe; alſo in America, 99—marine ones not very frequent, and why, 130

Vomit, black, a mortal ſymptom of the diſtemper called chapatonadas, in America, i. 323

Uranoſcopus, a prickly-finned apodal fiſh, deſcription of it, vi. 300

Urchins, or echini, a multivalve ſhell-fiſh—manner of exhibiting this extraordinary animal in every light—its deſcription—ſome kinds as good eating as the lobſter, and its eggs conſidered as a great delicacy, vii. 61 to 63

Urinary paſſages, effects of the cantharides falling principally upon them, viii. 143

Urine of animals found efficacious in ſome diſorders, iii. 69—of the lion, inſupportable, 224—of camels, an ingredient in ſal ammoniac, iv. 311—of birds, differs from that of other animals, v. 17

Urſon, or *Hudſon*, of the hedge-hog kind, a native of Hudſon's Bay—its deſcription—ſleeps much, and feeds upon the bark of juniper—in winter ſnow ſerves it as drink, and in ſummer it laps water like a dog, iv. 114, 115

Urus and biſon, in fact, deſcendants of one common ſtock; and naturaliſts, aſſigning them different claſſes, have ſeparated what is really united—this wild bull chiefly met with in Lithuania—deſcription of it—generally taken by pit falls—the breed chiefly occupies the cold and temperate zones, iii. 15 to 20

Vulture kind, vulture and dog, about Grand Cairo in Egypt, keep together in a ſociable friendly manner, and bring up their young in the ſame neſt, iii. 304—its diſtinctive marks from other kinds of carnivorous birds—the fleſh liked, and dreſſed for eating, according to Belonius, v. 85—of Senegal, ſaid to carry off children, probably no other than the condor, 105—ſeldom attacks living animals, when ſupplied with dead, 107—deſcription of the golden vulture, 108

Vulture, bird of prey, next in rank to the eagle, leſs generous and bold, v. 107—countries where found—unknown in England—flocks of them near Grand Cairo, not permitted to be deſtroyed, as they devour all the filth and carrion there—in company with wild dogs, tear and devour together without quarrelling—wonderful method of ſeparating the fleſh from the bones, and leaving the ſkin intire—ſmell carrion from afar—follow thoſe that hunt for ſkins alone, and ſo voraciouſly fill themſelves, as merely to waddle, and to want diſgorging before they fly away—are little apprehenſive of danger, and allow themſelves to be approached—an eagle falling in upon their meals, keeps them at diſtance till he be ſatiated—an ox returning home alone, lying down by the way, becomes their prey, and is devoured alive—attempt oxen grazing, deſtroy lambs, and feed much upon ſerpents, rabbits, hares, and what game they can overpower—demoliſh whole broods of crocodiles—lay two eggs at a time, and produce but once a year—make neſts in inacceſſible cliffs, and remoteſt places—their fleſh lean, ſtringy, nauſeous, taſting and ſmelling of carrion—the down of their wing makes a pretty kind of fur, commonly ſold in the Aſiatic markets, v. 109 to 114

Vultures (king of) deſcription of this bird, v. 115, 116

W.

Walfiſchaas, whales provender, inſects floating in cluſters on the ſurface of the ſea, and called meduſa by Linnæus, vi. 198

Walnut-trees, with walnuts on the ſtems, leaves, and branches, in exact preſervation, found at twenty-ſix feet depth, round the city of Modena in Italy, i. 282

Wanderow, a baboon leſs than the mandril, its deſcription—chiefly ſeen in the woods of Ceylon and Malabar, iv. 215

Wappe, dog of the mongrel kind, in the third diviſion of Dr. Caius, iii. 286

Warbling of birds, ſo loud and various in modulation, not eaſily accounted for, v. 14

Warine, the Braſilian guariba, largeſt of the monkey kind, found in America—its deſcription, iv. 235, 236

Warree, hog of the iſthmus of Darien, deſcribed by Wafer, iii. 196

Waſps, ruminating inſects, or ſeemingly ſuch, iii. 6—their deſcription and habits—their habitation ſcarcely completed, when the inhabitant dies—have two or three hundred queens in a hive—their neſt a moſt curious object—the ſocial waſps gather no honey themſelves, though fond of ſweets—fierce battles with the bees, who make up by conduct and numbers the deficiency of prowefs—their depredations—where found, other flies deſert the place—live but one ſeaſon—cannot endure winter—before new year they wither and die, having butchered their young—in every neſt, one or two females ſurvive—impregnated the preceding ſeaſon, ſhe begins in ſpring to lay eggs, and before June produces ten thouſand young, which are nurſed and fed by her alone—ſolitary waſp, its manners—proviſions made for the young at leaving the egg—the proviſions arranged and laid in, the old one cloſes the hole and dies—the young leaving the egg, are ſcarcely viſible—how the life of the young is ſpent—waſps of Europe innocent, compared to thoſe of tropical climates—deſcription of thoſe of the Weſt Indies, and their habits—pains of their ſting inſupportable, more terrible than of a ſcorpion; the part ſwells, and people are ſo disfigured as ſcarce to be known, viii. 96 to 110

Water, its parts infinitely ſmall, driven through the pores of gold, penetrating through all ſubſtances, except glaſs—enter the compoſition of all bodies, vegetable, animal, and foſſil—birds, beaſts, fiſhes, inſects, trees, and vegetables, with their parts, have growth from it, and by putrefaction become water—gives all other bodies firmneſs and durability—a phial hermetically ſealed, kept fifty years, depoſed no ſediment, and continued tranſparent—gathered after a thunder-clap, in ſultry weather, depoſits a real ſalt, i. 163 to 169—ſpring-water collected from the air—of river waters, the Indus and the Thames offer the moſt light and wholeſome—lightneſs, and not tranſparency, the teſt of purity—pureſt water diſtilled from ſnow on tops of higheſt mountains—different kinds adapted to different conſtitutions—very tranſparent—freſh water at ſea putrifies twice, ſometimes thrice, in a voyage—a month at ſea, ſends up a noiſome and dangerous vapour, which takes fire from a flame—elementary water not compounded—is ice kept in fuſion—dilates in bulk by cold—confirmed by experiments, 170 to 178—very compreſſible and elaſtic—made to reſemble air—a drop of water converted into ſteam, capable of raiſing twenty ton weight—keeps its ſurface level and even—a ſingle quart ſufficient to burſt a hogſhead, and how, 180 to 187, et ſeq.—water of the ſea heavier and more buoyant than freſh water, 241—of the ſea, kept ſweet by motion, 249—converted into ruſhing air, and again into its former ſtate, 337—the bramins of India ſmell the water they drink, to us quite inodorous, ii. 180

Water-ſpouts, burſt from the ſea, and join miſts immediately above them, i. 377—moſt ſurpriſing phœnomena, dreadful to mariners, and aſtoniſhing to obſervers of nature, common in the tropical ſeas, ſometimes in our own—deſcription of thoſe ſeen by Tournefort in the Mediterranean—ſolutions offered for this ſurpriſing phœnomenon, i. 390 to 396

Water-wagtail, ſlender-billed bird of the ſparrow kind, living upon inſects, v. 314

Waves, their luminous appearance in the night, and the cauſe, i. 247

Wax of two kinds gathered by common bees, viii. 88—the firſt fifteen days, the bees make more wax than during the reſt of the year, 86—that produced by black bees in tropical climates only uſed for medicinal purpoſes, being too ſoft for candles, as in Europe, 90

Weaſel, a ſmall carnivorous animal—marks common to the kind—theſe differ from the cat kind in the formation and diſpoſition of the claws—differ from the dog kind in a cloathing of fur rather than hair—one of the ſpecies is like all the reſt—this the ſmalleſt of the whole kind—its deſcription—untameable and untractable—hides and ſleeps three parts of the day, and ſallies forth for prey in the evening—attacks animals much above its own ſize, iii. 346 to 350—catches rats and mice better than cats; alſo ſmall birds—deſtroys young poultry, and ſucks the eggs—ſo nimbly runs up high walls, no place is ſecure from it—in cultivated lands, it thins the number of hurtful vermin—never cries but when ſtruck—all the kind has glands near the anus, ſecreting a ſubſtance fœtid in ſome, and a perfume in others—this moſt offenſive in ſummer, and inſufferable when irritated—one ſort in America is by ſailors called the ſtinkard—confined to a cage, is ever in uneaſy agitation—muſt have leave to hide itſelf—eats only by ſtealth, and will not touch the food until it begins to putrefy—the female makes an eaſy bed for her young, and generally brings forth from three to five at a time, and with cloſed eyes—account of a weaſel's forming her neſt, and bringing forth her young, in the putrid carcaſe of a wolf—the white ermine found in Great Britain is called the white weaſel—its fur among us of no value, 350 to 358—of the weaſel kind, the martin the moſt pleaſing, 368—the boldeſt and moſt uſeful of all is the ichneumon, 376. See *Stinkards*, iii. 380

Weather, the moiſt alone prevents evaporation, i. 371

Weathercocks often erroneous with Derham in regard to upper regions, i. 353

Weed, floating over great tracts of the ſea, ſerve as ſuſtenance for many fiſh bearing ſimilitude with ſuch vegetables, ii. 7

Weever, the trachinus, a prickly-finned jugular fiſh, its deſcription, vi. 300—the ſting given by its back-fin is poiſonous, 342

Weight of the human body often found to differ from itſelf—inſtances of it—the difference often amounts to a pound, or ſometimes to a pound and a half—not eaſy to conceive whence this adventitious weight is derived, ii. 110—the porters of Conſtantinople carry burdens of nine hundred pounds weight—a man able to raiſe a weight of two thouſand pounds—a horſe will not carry upon its back above two or three hundred pounds—whence this ſeeming ſuperiority comes, 112

Well, burning, at Broſely, now ſtopped, had a fire-damp in it, which would kindle with the flame of a candle, i. 86—ſome continue full, affected neither by rains nor droughts, 282

Welland, river near Spalding, has amazing ſhoals of ſticklebacks caught in it, vi. 328

Wert (Sebald) a traveller, confirms the exiſtence of giants, on a coaſt of South America, towards the ſtreights of Magellan, ii. 261

Whale, the largeſt animal known; no preciſe anatomy of this fiſh yet given—two centuries ago they were deſcribed two hundred and fifty feet long—the Biſcayneers practiſed the whale-fiſhery near Greenland, ſoon after the year 1300—ſeven different kinds, diſtinguiſhed by external figure, or internal conformation—are gregarious animals; make migrations from one ocean to another—and generally reſort where they have the leaſt diſturbance—great Greenland whale, its deſcription—from ſixty to ſeventy feet long—the head one third of its bulk—its hearing is acute—breathes air at the ſurface of the water, and cannot remain under it like other fiſhes—it blows loudly through the ſpout-holes, and moſt fiercely when wounded—whalebone different from the bones of the body—the fins are from five to eight feet long—the throat is narrow, nothing larger than a herring can be ſwallowed—the tail, its only weapon of defence, is twenty-four feet broad, and ſtrikes hard blows—one ſeen by Ray, marbled, with the figures 122 diſtinctly marked upon it—the blubber and other parts turn out to very good account—the fleſh palatable to ſome nations—the female and male keep much together; their fidelity exceeds that of birds—inſtance of it—do not croſs breeds—ſhe goes with young nine or ten months, is then fatter than at other times—produces two breaſts and teats at pleaſure—ſuckles her young a year, and how—is very tender of them—defends them fiercely when purſued—inſtance of it—dives with them, and comes up ſoon to give them breath—during the firſt year, called ſhort-heads, and then yield fifty barrels of blubber—at two years, they are ſtunts, and after that ſkull-fiſh—the food of this animal, an inſect called meduſa by Linnæus, and walfiſchaas by the Icelanders—purſues no other fiſh, and is inoffenſive in its element—the whale-louſe, of the ſhell-fiſh kind, ſticks to its body, as to the foul bottom of a ſhip, gets under the fins, and eats through the ſkin into the fat—the ſword-fiſh affrights the whale, avoids the ſtroke of its tail, bounds upon its back, and cuts into it with the toothed edges of its bill—the killer, a cetaceous fiſh of great ſtrength, with powerful teeth, beſet the whale as dogs do a bull, tear it down, and then devour only its tongue—old manner of taking whales—improvements hinted, vi. 187 to 206

Whale (ſpermaceti). See *Cachalot.*

Wheat and currants, ſwallowed whole, indigeſtible to man; ſo may many kinds of food be in the ſtomachs of animals, v. 74

Wheat-ear, a thick ſhort-billed bird of the ſparrow kind, thought foreign, v. 315—it migrates before winter, 318

Whin-chat, a ſlender-billed bird of the ſparrow kind, v. 314—bird of paſſage, 318

Whip-ſnake, a very venomous ſerpent of the Eaſt, is five feet long, and its bite kills in ſix hours time, vii. 214, 215

Whirlpool, manner in which it is formed, i. 265—thoſe of the ocean particularly dangerous, 267—the central point always loweſt, and why, 205

Whirlwind, the moſt rapid formed by united contributions of minerals, vegetables, and animals, increaſing the current of air, i. 338

Whiſkers, a man without them formerly conſidered as unfit for company in Spain; nature denying, art ſupplied the deficiency—a Spaniſh general borrowing money from the Venetians, pawned his whiſkers, and took care to releaſe them—part of the religion of the Tartars conſiſts in the management of their whiſkers; and they waged war with the Perſians as infidels, whoſe whiſkers had not the orthodox cut—the kings of Perſia wore them matted with gold thread; and the kings of France, of the firſt races, had them knotted and buttoned with gold, ii. 96, 97

Whiſton, his reaſoning concerning the theory of the earth—finds water enough in the tail of a comet for the univerſal deluge, i. 28 to 32

White, the natural colour of men, all other tints proceed from greater or leſſer heat of climates, ii. 233—among white races of people, our own country bids faireſt for pre-eminence, 235

White-bait, ſhoals appear near Greenwich in July, and ſeem the young of ſome animal not come to perfect form, vi. 331

White-noſe, the *mouſtoc*, monkey of the ancient continent, a beautiful little animal—its deſcription—a native of the Gold Coaſt, iv. 234

White-throat, a ſlender-billed bird of the ſparrow kind, living upon inſects, v. 314

Widgeon, a variety of the European duck, deſcribed, but beſt known by its whiſtling ſound, vi. 127

Wild man of the woods. See *Ouran-outang*, iv. 189

Wind, a current of air—artificial—cauſes aſſigned for the variety, activity, continual change, and uncertain duration of it—in what manner to foretel the certainty of a wind, as the return of an eclipſe—to account for variations of wind upon land, not at preſent expected—recourſe to be had to the ocean, and why—in many parts of the world the winds pay ſtated viſits—in ſome places they blow one way by day, and another by night; in others, for one half year they go in a direction contrary to their former courſe; in ſome places the winds never change—the wind which never varies is the great univerſal wind, blowing from the eaſt to the weſt, in all extenſive oceans, where the land does not break the general current—the other winds are deviations of its current—many theories to explain the motion of the winds—that of Dr. Lyſter—theory of Carteſius—Dr. Halley's more plauſible, i. 337 to 342, & ſeq.

Winds (trade) blow from the poles toward the equator—were the ſurface of the globe ſea, the winds would be conſtant, and blow in one direction—various circumſtances break its current, and drive it back againſt its general courſe, forcing it upon coaſts that face the weſt—want of a true ſyſtem of trade-winds, ſupplied by an imperfect hiſtory of them—north wind prevails during

October, November, December, and January, in the Atlantic, under the temperate zone—north wind reigns during the winter of Nova Zembla, and other arctic countries—ſouth wind prevails during July in the Cape de Verde iſlands—north-weſt wind blows during September at the Cape of Good Hope—regular winds produced by various cauſes upon land—ancient Greeks firſt obſerved them—in general, wherever a ſtrong current of water, there is a wind to attend it—regular wind produced by the flux and reflux of the ſea—winds called *monſoons*—ſome peculiar to certain coaſts—ſouth wind conſtant upon thoſe of Chili and Peru—other winds particular to various coaſts, i. 343 to 349

Winds at land puff by intervals, and why—not ſo at ſea—eaſt wind more conſtant than any other, and generally moſt powerful—wind blowing one way, and clouds moving another, forerunners of thunder—cauſe of this ſurpriſing appearance remains a ſecret—from ſea, generally moiſter than thoſe over tracts of land—more boiſterous in ſpring and autumn than at other ſeaſons—their force does not depend upon velocity alone, but alſo upon denſity—reflected from ſides of mountains and towers, often more powerful than in direct progreſſion—raiſe ſandy deſerts in one country, to depoſit them upon ſome other—ſouth winds in ſummer, ſo hot in Egypt as almoſt to ſtop reſpiration, and produce epidemic diſorders, continuing for any length of time—deadly along the coaſts of the Perſian Gulph, and of India—aſſume a viſible form, i. 352 to 359

Wind-pipe, in men has a lump not ſeen in women, ii. 102—makes convolutions within a bird, and is called the labyrinth, v. 13—this difference obtains in birds ſeemingly of the ſame ſpecies, 14—ſtrange in the throat of the crane, 377—of the bittern, vi. 2—in the wild ſwan, 112

Wings of birds, anſwer fore-legs of quadrupedes—their deſcription—baſtard wing, v. 7—flap of a ſwan's wing breaks a man's leg; a ſimilar blow from an eagle lays a man dead inſtantly, 9—of butterflies, diſtinguiſh them from flies of other kinds—their number and beautiful colours, viii. 33

Winter beginning round the poles, the miſty appearance of heat in ſouthern climates is there produced by cold, i. 377, 386

Wiſtiti, a monkey of the ſagoin kind, remarkable for the tufts of hair upon its face, and its annulated tail, iv. 237

Wolga, its length—abounds with water in May and June; at other times very ſhallow—the Engliſh diſappointed in a trade into Perſia through it, i. 209—receives thirty-three leſſer rivers in its courſe, 217—and has ſeventy openings into the Caſpian ſea, 131

Wolf, a fierce, ſtrong, cunning, carnivorous quadrupede, externally and internally ſo nearly reſembling the dog, they ſeem modelled alike, yet have a perfect antipathy to each other, iii. 306—principal diſtinction from the dog is the eye, which opens ſlantingly upwards in the ſame direction with the noſe, 307—alſo the tail is long, buſhy, hanging lank—the wolf lives about twenty years—is not much with thoſe of his kind, yet hunts in packs with them, iii. 311—quarelling, they devour each other, iii. 310—is watchful and eaſily waked——ſupplied with water, lives four or five days without food—carries off a ſheep without touching the ground, and runs with it ſwifter than the ſhepherds his purſuers, 315—ſmells a carcaſe at a great diſtance, 316—leaving the wood, goes out againſt the wind—particularly fond of human fleſh—follow armies, and arrive in numbers upon a field of battle—two or three wolves keep a province for a time in continual alarm, 317—diſtinguiſhed by huntſmen into young, old, and great wolf—manner of hunting them, 318—young dogs ſhudder at their ſight, 309—the wolf killed, no dogs ſhew an appetite to enjoy their victory, 318—the fleſh ſo very indifferent, no creature eats it but the kind itſelf—breathe a moſt fœtid vapour from their jaws, 323—often die of hunger, after running mad by furious agitations, 109—ſeaſon for coupling laſts but fifteen days—no ſtrong attachment appears between male and female; ſeek each other only once a year—couple in winter, ſeveral males then follow one female, diſpute cruelly, growl, and tear each other, and ſometimes kill that preferred by the female—ſhe flies from all with the choſen when the reſt are aſleep, 311—males paſs from one female to the other—time of pregnancy about three months and a half—couple like the dog, and the ſeparation hindered by the ſame cauſe—bring forth five or ſix, to nine at a litter—the cubs brought forth with eyes cloſed, 312—young wolves play with hares or birds brought by their dams, and end by killing them, 313—able to engender when two years old, 314—wild dogs partake of the diſpoſition of the wolf, 276—the wolf taken young is gentle only while a cub; as it grows older, diſcovers its natural appetite of rapine and cruelty, 277—experiments prove neither wolf nor fox of the ſame nature with the dog, but each a diſtinct ſpecies, 298 to 300—France, Spain, and Italy, much infeſted with them; England, Ireland, and Scotland, happily free—king Edgar firſt attempted to rid this kingdom, and in what manner, 319—Edward I. iſſued a mandate to Peter Corbet for the deſtruction of them—ſome quite black, ſome white all over—found in Aſia, Africa, and America, 320—in the Eaſt trained up for ſhew, taught to dance and play tricks; one thus educated ſells for four or five hundred crowns—in Lapland, the wolf never attacks a rein-deer when haltered—wolves of North-America uſed in hunting, 321, 322—caught in pit-falls; a wolf, a friar, and a woman taken in one in the ſame night, 319

Wolf, (golden) the Latin name for the jackall, iii. 334

Wolf-fiſh, the anarbicas, a ſoft-finned apodal fiſh, its deſcription, vi. 305

Womb, hiſtory of the child in the womb, ii. 39—of the hare divided into two, as a double organ, one ſide of which may be filled, while the other remains empty, iv. 6—deſcription of the falſe womb of the oppoſſum, 243, et ſeq.

Woman, the body arrives at perfection ſooner than in men, ii. 79—the perſons of women as complete at twenty as thoſe of men at thirty, 80—the bones, cartilages, muſcles, and other parts of the body, ſofter than in men—a woman of ſixty has a better chance than a man of that age to live to eighty—women longer in growing old than men, 199—the ſhoulders narrower, and the neck proportionably longer than in men, 107—after a catalogue of deformities, Linnæus puts down the ſlender waiſts of the women of Europe, by ſtrait lacing, deſtroying their health, through a miſtaken notion of improving their beauty, 243—leſs apt to become bald than men; Mr. Buffon thinks they never become bald; there are too many inſtances of the contrary, 86—in the polar regions as deformed as the men, 214—women of India deſcribed—marry and conſummate at eight, nine, and ten years old, and have children at that age—ceaſe bearing before the age of thirty—thoſe of ſavage nations, in a great meaſure exempt from painful labours, 224—ſome continue pregnant a month beyond the uſual time—thoſe of Africa deliver themſelves, and are well a few hours after, 47—remarkable inſtance of the power of imagination upon the fœtus, 246—lower eye-lids drawn downwards when with child—the corners of the mouth alſo—then likewiſe high ſhouldered—circumſtances under which the midwives call them all mouth and eyes, 104—in barbarous countries, the laborious duties of life thrown upon the women, 71, 121—the chief and only aim of an Aſiatic is poſſeſſion of many women, 72—inſtance, in our country, of a fine woman married to an eunuch, 74—a principal employment of thoſe of Thibet, is reddening the teeth with herbs, and making their hair white, 77—firſt impulſe of ſavage nature confirms women's ſlavery; the next, of half barbarous nations, appropriates their beauty; and that of the perfectly polite engages their affections, 122

Woods, in Britain, cut down by the Romans, and for what reaſon, i. 286

Wood-cock, or *cock of the wood*, of the grouſe kind, places which this bird inhabits—how diſtinguiſhed from other birds of the poultry kind—the delicacy of its fleſh—its food and habitation—amorous deſires firſt felt in ſpring—keeps to the place where he firſt courts, and continues till the trees have their leaves, and the foreſt is in bloom—its cry, clapping of wings, and ridiculous poſtures in this ſeaſon—during which the females, attending his call, are impregnated; ſportſmen uſe this time to fire at them, and take many while thus tame, though at others it is moſt timorous and watchful—the female much leſs than her mate, and ſo unlike him in plumage, ſhe might be miſtaken for another ſpecies—

number and ſize of the eggs—ſhe hatches them without the cock; and when obliged to leave them, in queſt of food, ſo covers them with moſs or leaves, it is difficult to find them—ſhe is then extremely tame and quiet—keeps her neſt, though attempted to be driven away—the young being hatched, they run with agility after the mother, though ſcarcely diſengaged from the ſhell—their food ant's eggs and wild mountain berries—older, they feed upon tops of hether, and cones of pine-trees—are hardy—the clutching time over, the young males forſake the mother; keep together till ſpring, when the firſt genial acceſs ſets them at variance for ever—fight each other like game-cocks, and eaſily fall a prey to the fowler, v. 200 to 204

Woodcock, bird of the crane kind, its dimenſions, vi. 22—food, 24—is a bird of paſſage—places where it is to be found, 27

Woodchat, a rapacious bird, third kind of the butcher-bird, v. 136

Wood-louſe, its deſcription—has three varieties—where found—how bred—are of uſe in medicine, vii. 286, 287

Wood-pecker, of this bird are many kinds, and varieties in each—general characteriſtics—deſcription of the *green wood-pecker*, or *wood-ſpite*, called the *rain-fowl* in ſome parts—feeds upon inſects, particularly thoſe in hollow or rotting trees—deſcription of its tongue, the inſtrument for killing and procuring food—want that inteſtine, which anatomiſts call the cæcum—ſtratagem uſed by them to catch ants—in what manner they make neſts, and how delicate in the choice—number of eggs—neſts in warmer regions of Guinea and Braſil—*little wood-pecker*, called by the narives of Braſil *guiratemga*, v. 248 to 255

Woodward, his eſſay towards a natural hiſtory, detail of it, i. 26 et ſeq.

Wool, the Spaniſh finer than ours; but in weight not comparable to that of Lincoln or Warwickſhire—ſome Spaniſh wool required to work up with it, iii. 44—of the pacos, moſt valuable, and formed into ſtuffs, not inferior to ſilk; this manufacture a conſiderable branch of commerce in South America, iv. 317

Worms, within the body of the caterpillar, devour its entrails, without deſtroying its life, viii. 47—of different kinds infeſt each ſpecies of fiſh, vi. 341—*ſea-worms* make the ſhells of fiſhes their food, vii. 16

Blind worm, of the ſerpent kind, its deſcription—lies torpid all winter, vii. 221

Froth-worm, an inſect in that ſort of ſubſtance on the ſurface of plants—deſcription of it, vii. 358

Worm-kind, general deſcription of the *earth worm*—entirely without brain, but with the heart near the head—in what manner taken—its eggs—nouriſhment—keeps life in ſeparated parts, viii. 166 to 170

Wraſſe, the labrus of the prickly-finned thoracic kind—deſcription of this fiſh, vi. 301

Wren, and *golden crowned wren*, ſlender-billed birds of the ſparrow kind, v. 314—*willow-wren*, a wandering bird of the ſparrow kind, 318—the ſinging bird admired for the loudneſs of its note, compared to the ſmallneſs of its body, 335

Wrinkles. See *Skin*, ii. 197

Wry-neck, or *cuckoo's attendant*, a little bird, moſt active in the chaſe of the young cuckoo, v. 266

X.

Xiphias, or the *ſword-fiſh*, of the prickly-finned apodal kind, its deſcription, vi. 299

Y.

Young people ſometimes ceaſe growing at fourteen or fifteen, ii. 79

Z.

Zealand, inundations there, in which many villages were and remain overflowed, i. 278

Zebra, the moſt beautiful, but wildeſt animal—a native of the ſouthern parts of Africa—nothing exceeds the delicate regularity of its colour—deſcription—watchful and ſwift—its ſpeed a proverb among Spaniards and Portugueſe—ſtands better upon its legs than a horſe—in what countries found—the Portugueſe pretend to have tamed, and ſent four from Africa to Liſbon, to draw the king's coach—ſome ſent to Braſil, could not be tamed—Merolla aſſerts, when tamed, they are ſtill as eſtimable for ſwiftneſs as beauty—their noiſe reſembles the confuſed barking of a maſtiff dog—in two, the author ſaw the ſkin below the jaw upon the neck hung looſe in a kind of dewlap—they are eaſily fed; ſome in England eat bread, meat, and tobacco—the emperor of Japan made a preſent of ſixty thouſand crowns value, for one received from a governor of Batavia—the Great Mogul gave two thouſand ducats for another—African ambaſſadors to the court of Conſtantinople, bring ſome with them, as preſents for the Grand Seignor, ii. 390 to 399

Zebu, the *Barbary cow*, and the *grunting* or *Siberian cow*, are but different races of the *biſon*, iii. 23, 24, 32

Zeiran, name of the fourth variety of gazelles by Mr. Buffon, iii. 73

Zembla, Nova, north wind reigns there during winter, i. 346—a deſcription of its inhabitants, ii. 213, et ſeq.

Zeus, the *doree*, of the prickly-finned thoracic kind, deſcription of that fiſh, vi. 303

Zibet, one of the two ſpecies of the civet, according to Mr. Buffon—diſtinction between them, iii. 389

Zone, (temperate) properly ſpeaking the theatre of natural hiſtory, i. 14

Zone, (torrid) in the center the heat very tolerable, in other places the cold painful—temperature and advantages of perpetual ſpring under it, i. 150—lightening there not fatal or dangerous, 379—has the largeſt quadrupeds—all fond of the water, iii. 28, 29

Zoophytes, name of vegetable nature endued with animal life, viii. 161—firſt claſs of zoophytes, 166—all the tribe continue to live in ſeparate parts; one animal by cuttings, divided into two diſtinct exiſtences, ſometimes into a thouſand, 171—ſecond claſs, 174

Zorille, a ſtinkard, of the weaſel kind—reſembles the ſkink—is ſmaller and more beautifully coloured, iii. 381

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9 OCT 48

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